The Chemical Age

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International Chemistry

THE international spirit in chemical science and industry will find expression under happy auspices at the ninth International Congress of Pure and Applied Chemistry, which is to be held at Madrid from April 3 to 10, when representatives of Great Britain will meet on common ground with chemists from other countries with the combined object of promoting the interests of chemistry and strengthening the relations between its practitioners in all parts of the world. The Madrid Congress, which was in contemplation long before the political upheaval in Spain last year, has the cordial support of the entire Government of the Spanish Republic. The executive committee of the Congress, strengthened by such influential support, has invited chemical organisations throughout the world to participate. The period chosen for the Congress synchronises with a series of festivals and religious ceremonies in a number of neighbouring towns, and the dates of the celebrated Andalusia Fair, and in the compilation of the Congress programme due regard has been had to facilities for sight seeing.

The principal officers of the Congress are the honorary president, Mr. J. R. Mourelo, vice-president of the Academy of Science and professor emeritus of the School of Arts; the president, Mr. O. Fernandez, professor of the University, member of the Academy of Science and dean of the Academy of Pharmacy; and the general secretary, Mr. E. Moles, a professor of the University and of the National Institute of Chemistry and Physics and president of the Spanish Society of Chemistry and Physics. Membership of the Congress is divided into three categories, (a) honorary members, comprising all members of the committee of honour and of patronage, and the official delegates of the Spanish Government and of the Governments of other countries, (b) supporting members and (c) active members. The Congress will be divided into six groups, the first five of which will comprise two sections, (a) pure and (b) applied, as follows: Group 1, physical and theoretical chemistry; group 2, inorganic chemistry; group 3, organic chemistry; group 4, analytical chemistry; group 5, biological chemistry; group 6, teaching and economics.

The Provisional Programme

EMPHASIS has been laid by the organising committee on the fact that the maximum of benefit from the Congress will lie, not in the description by the various authors of the entire contents of the general lectures or of the theses presented, which can quite well be read beforehand by the members, but in the discussion and interchange of ideas arising from them between the representative specialists from the various countries. It has, therefore, been arranged that summaries only of the papers will be given at the sessions, thus leaving as much time as possible for the discussions. The following provisional programme indicates the general nature of the Congress and the time allowed for recreation: Sunday, April 3, 6.30 p.m., reception. Monday, April 4, 10 a.m. to 1 p.m., opening of Congress and general lecture on "The Raman Effect in Connection with the Chemical Constitution," with discussion; 4 to 6 p.m., meetings of groups and sections, and presentation and discussion of reports. Tuesday, April 5, 6.30 p.m., reception. Wednesday, April 6, 9.30 a.m. to 1 p.m., general lecture on "The High Polymers in Chemistry," with discussion; 3.30 to 6 p.m., meetings of groups and sections; 6.30 p.m., reception.

Friday, April 8, 9.30 a.m. to 1 p.m., general lecture on "The Chemistry of High Temperatures," with discussion; 4 p.m., first meeting of the Council of the International Union; 4 to 6 p.m., meetings of groups and sections; 9 p.m., official dinner. Saturday, April 9, 10 a.m., second meeting of the Council; 10 a.m. to 12 noon, meetings of sections and drafting of conclusions; 4 p.m., closing session; 5 p.m., general assembly of the International Union. Thursday, April 7, and Sunday, April 10, are reserved exclusively for excursions.

Commissions and committees will eventually meet to deal with economics, international atomic weights, reforms of the nomenclature of biochemistry, physico-chemical standards, thermochemistry, annual tables of constants and unification of abstracts.

France to Buy German Nitrate

THE French Ministry of Agriculture has issued an official statement to the effect that an accord has been concluded between the Comptoir Francais de l'Azote and the German Stickstoffsyndicat providing that France shall buy from Germany the whole of her surplus nitrate requirements for 1932 over and above her own production and her Chilean imports up to date. It is calculated that this will mean orders for about 150,000 tons of German nitrate. Though the agreement nominally covers only one year, it is renewable, and if it is to continue next year it will be of great interest to know whether it will then cover the whole of France's surplus nitrate requirements. This nitrate year Chile had already exported about 200,000 tons of nitrate to France before the German contract was signed, but that is no assurance that France will take the same amount from her in 1932-1933. In the year to June 30, 1930, France took 379,000 tons of Chilean nitrate and held a stock of 130,000 tons, and the situation created by the new agreement is therefore of great importance to Chile. However significant the French move may appear in itself, it is only part of a tendency in nitrate policy all over the world. Besides France, there are now severe import restrictions in Germany, Belgium, Holland, Czechoslovakia and Poland.

The Teaching of Applied Chemistry

AN extension of that cordial co-operation between education authorities and employers which is so marked a feature of present day development is urged by the inspectors who act as advisers to the Board of Education in respect of classes in pure and applied chemistry, in an informative Report lately issued by the Board on "The Teaching of Applied Chemistry." This Report (Education Pamphlet No. 85, Industry Series No. 10, H.M. Stationery Office, 1s. net) reviews the instruction of more than 5,500 students in applied chemistry and discusses the relation of the training given in these classes to the needs of chemical industries. Improvements in the character and standard of the work in pure chemistry, especially since the National Certificate scheme was established, have had a beneficial effect on the character and standard of work in applied chemistry. The number of students who are pursuing their studies with an adequate foundation of pure science has increased considerably, and this is reflected in the increased amount of advanced and post-graduate work which is done in the larger institutions.

This particular development is an indication of considerable enterprise on the part of technical schools and colleges, and it has been aided largely by the increasing co-operation of local education authorities and employers. Local education authorities are usually willing to provide instruction for which there is a reasonable demand, but the development is not uniform, and there is still much to be done in most of the industrial areas before the standard of the most highly organised areas is attained. Meanwhile, extensions and adaptations are always taking place. The greatest needs at the moment are the provision of varied courses for men performing different functions, the co-ordination of schools and colleges and the transfer of capable evening students to part-time day classes, and the organised provision, over wider areas, of instruction of an advanced and specialised character. The last three involve organisation based on industrial areas rather than on areas defined by local government boundaries, and it is in this direction that the inspectors advocate extended co-operation.

Books Received

REPORT OF THE FUEL RESEARCH BOARD FOR THE YEAR ENDED MARCH 31, 1931. Department of Scientific and Industrial Research. London: H.M. Stationery Office. Pp. 104. 2s.

PRINCIPLES OF PATENT LAW FOR THE CHEMICAL AND METALLURGICAL INDUSTRIES. By Anthony William Deller. New York: The Chemical Catalog Co. Inc. Pp. 483. $6.00.

OFFICIAL AND TENTATIVE METHODS OF ANALYSIS OF THE ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS. Washington, U.S.A.: Association of Official Agricultural Chemists. Pp. 593.

CHEMICAL ARITHMETIC. By Saul B. Arenson. London: Chapman and Hall, Ltd. Pp. 108. 7s. 6d.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH. Report for the year 1930-31. London: H.M. Stationery Office. Pp. 186. 3s.

WATER POLLUTION RESEARCH. SUMMARY OF CURRENT LITERATURE. Vol. V, No. 1. January, 1932. London: H.M. Stationery Office. Pp. 36. 2s.

ECONOMIC CONDITIONS IN GERMANY. September, 1931. Report by J. W. F. Thelwall and R. P. F. Edwards. London: H.M. Stationery Office. Pp. 282. 4s.

HYDROGEN IONS. By Hubert T. S. Britton. London: Chapman & Hall, Ltd. Pp. 590. 25s.

CHINA-CLAY (KAOLIN).—Imperial Institute Mineral Resources Bulletin. London: H.M. Stationery Office. Pp. 100. 1s. 6d.

REPORT OF THE WATER POLLUTION RESEARCH BOARD for the year ended June 30, 1931. London: H.M. Stationery Office. Pp. 40. 9d.

ECONOMIC CONDITIONS IN THE NETHERLANDS EAST INDIES, September, 1931. By H. A. N. Bluett. London: H.M. Stationery Office. Pp. 126. 3s. 6d.

The Calendar

Jan. 25.—Institution of the Rubber Industry. "A Sales' Organisation," by R. H. Comley. 7.30 pm. First Avenue Hotel, London.

Jan. 26.—Royal Photographic Society. Scientific and Technical Group. 7 p.m. 35 Russell Square, London.

Jan. 27.—British Association of Chemists (Manchester Section). "Science and Modern Society," by H. T. F. Rhodes. 7.30 p.m. Grand Hotel, Aytoun Street, Manchester.

Jan. 27.—Royal Society of Arts. "The Permanence of Artists' Materials," by Noel Heaton. 8 p.m. John Street, Adelphi, London.

Jan. 28.—Society of Dyers and Colourists (West Riding Section). "Influence of (a) Raw Materials, (b) Yarn and Cloth Structure, on Dyed Woven Fabrics," by Professor E. Midgley.

Jan. 29.—Society of Dyers and Colourists (London Section). "The Society's Fastness Tests," by Dr. P. W. Cunliffe.

Jan. 29.—Society of Chemical Industry and Institute of Chemistry. "The Future of Liquid Fuels," by Dr. A. E. Dunstan. 7.30 p.m. 36 York Place, Edinburgh.

Jan. 29.—Manchester Literary and Philosophical Society. "The Trend of Recent Developments in Enzyme Chemistry," by Dr. T. K. Walker. 7 p.m. 36 George Street, Manchester.

Fatty Alcohols and their Sulphonated Products

Applications in the Textile Industry

The following paper was read before the Huddersfield Section of the Society of Dyers and Colourists, January 19, by Mr. M. Briscoe, B.Sc., A.I.C., of the firm of Ronsheim and Moore (London), who are associated with the Deutsche Hydrierwerke A.G. (Berlin-Charlottenburg).

THE value of the sulphonated fatty alcohols had been very adequately studied in the laboratory and the supreme merits of the products demonstrated before it was commercially possible to produce the fatty alcohols on a large scale.

The disadvantages of soap are very marked. It does not stand up against acid, for in an acid bath the free fatty acid of the soap is liberated, and as this free fatty acid is not soluble in water it has no scouring or texile value. Soap, moreover, cannot be used in sea water; neither will it stand up to ordinary hard waters. With such waters, calcium and magnesium salts of the fatty acids are formed and are insoluble. These "lime soaps" are somewhat sticky and glutinous and contaminate cleaning processes, giving trouble in dyeing, bleaching and finishing. As derivatives of the free fatty acids the soaps are also liable to turn rancid, any lime soaps left in the fabric resulting in a disagreeable smell. The uneven fixing of such lime soaps in the fibres of the material after scouring makes subsequent even dyeing a difficult problem, and white fabrics, in particular, may go greyish or yellowish.

Sulphonated Oils

The earliest attempt to overcome the disadvantage of soap was taken in the direction of producing sulphonated oils. Those still used in commerce are of the Turkey Red oil type, and consist of castor oil or some similar oil rendered soluble by treatment with sulphuric acid. A typical example is that of ricinoleic acid. The early sulphonated oil of commerce was the sodium salt of this body, and was certainly an improvement in some respects on soap. The free acid as liberated in acid solution was water soluble, whilst the oil itself was not so readily affected by hard water because the calcium salts were relatively soluble in water. For many purposes, therefore, these sulphonated oils replaced soap, particularly in the finishing section of the textile trade. As general substitutes for soap, however, they could not really be regarded seriously, for their wetting-out powers, emulsifying properties and lathering and cleansing actions were poor.

The problem of producing more effective bodies than soap was then tackled on two separate lines. Attempts were made to evolve bodies on entirely different basis with entirely different chemical structure, e.g., the alkyl naphthalene sulphonic acids, such as Nekal. These were very valuable for certain purposes and some of the members of this group had remarkable wetting-out powers, but they had no real "soap" properties. The sulphonated oils themselves were also studied very deeply with a view to modification in structure. The conclusion was reached by one group of research workers that it is really the COOH-group which is responsible for the relative want of resistance to lime salts, and early attempts were therefore made to modify the COOH group. One such attempt consisted in first making the butyl ester of ricinoleic acid and sulphonating this so that the group contained $COO(C_4H_9)$; another attempt converted the COOH group into the acid amide group $CONH_2$.

These modified sulphonated oils possessed remarkable wetting-out properties, great resistance to acids and salts, but no cleansing or emulsifying properties at all comparable with soap. They were also somewhat sensitive to alkalis. Workers in this field finally reached the conclusion that success was only likely to be achieved by the complete elimination of the COOH-group.

Sulphonated Fatty Alcohols

If one looks at the formula for a typical sulphonated oil such as ricinoleic acid, $CH_3(CH_2)_5.CH(OH).CH_2.CH:CH.(CH_2)_7.CO_2H$, it is readily seen that the elimination of the COOH-group would leave an alkyl sulphuric acid ester. It is therefore obvious that to produce an alkyl sulphuric acid ester one must start initially, not with a fatty acid, but with a fatty alcohol whereby the OH-group so typical of alcohols can be esterified in the more or less usual manner:—

$$C_nH_{(2n+1)}OH \qquad C_nH_{(2n+1)}OSO_2OH$$

Such alkyl sulphuric acid esters were prepared in the laboratory, their properties studied in detail, and it was found that they fulfilled all expectations. These products, here regarded as sulphonated fatty alcohols, have excellent wetting-out powers, far surpassing those of soap and the sulphonated oils, excellent emulsifying properties, adequate stability to acid solutions as the free acids are soluble in water, and complete stability to alkalis. They do not separate any alkali hydrolytically, thus giving if required a completely neutral solution. They are also completely resistant to sea water and to hard waters, as the calcium and magnesium salts are absolutely soluble; have pronounced "fatty" characters; but are free from rancidity on storage so that there is no possibility of deterioration.

Researches of Deutsche Hydrierwerke A.G.

In view of these properties it was obvious that a ready market was awaiting the sulphonated fatty alcohols. The problem, therefore, became one of producing the fatty alcohols in bulk at reasonable prices, and this work was taken in hand by the Deutsche Hydrierwerke A.G., Berlin-Charlottenburg, under the leadership of Professor Dr. W. Schrauth. The classical laboratory method of producing saturated fatty alcohols by the reduction of the ethyl ester of the corresponding fatty acid with metallic sodium and alcohol, however, was obviously an impossible process for bulk production. The process of reduction had to be simplified, whilst the raw materials used had to be naturally occurring products and not products which in themselves have to be synthesised first or else extracted with difficulty from natural products. This work was completely successful, for it was found possible by using a process of catalytic hydrogenation at high pressures to produce the fatty alcohols not merely from artificially prepared esters of the corresponding fatty acids, but also from naturally occurring esters such as the glyceryl esters (i.e., the fats from natural waxes, etc.) and from the free fatty acids themselves. This work was commenced in the laboratories of the Deutsche Hydrierwerke A.G. in 1927.

Lorol technical is the name given to the mixture of saturated fatty alcohols derived from the hydrogenation of cocoanut oil, or the free fatty acids of cocoanut oil. All the even-numbered saturated fatty alcohols from C_6 to C_{18} are present, but the main constituent is the C_{12} alcohol known as lauryl or dodecyl. The C_{12} alcohol comprises some 60 per cent. of the total alcohol mixture, the remainder consists almost entirely of the even-number saturated alcohols below and above C_{12}. This product is liquid at summer temperature. Lanette wax (stearine alcohol) is a solid white wax-like material which is a mixture of hexadecyl or cetyl alcohol (C_{16}) and octadecyl or stearyl alcohol (C_{18}), which can be obtained by the hydrogenation of commercial stearine. By fractional distillation it is possible to separate these technical mixtures into the individually pure alcohols, for which a market exists in the perfumery trade.

Not satisfied with producing the saturated fatty alcohols alone the Deutsche Hydrierwerke A.G. turned their attention to producing unsaturated fatty alcohols. Under the name of Ocenol there is now available an unsaturated fatty alcohol, known in Germany as olein alcohol. This is the alcohol corresponding to oleic acid. It is related to stearyl alcohol exactly as is oleic acid to stearic acid.

The Sulphonation Process

In one process sulphuric acid in the presence of acetic anhydride is used at 100° C: in another, chlorsulphonic acid is used at 30° C; in a third, fuming sulphuric acid is employed. The first and second of these methods yield an alkyl sulphuric acid ester, that is, one with the OSO_2OH group. The third method gives a true sulphonic acid with the SO_2OH group. The alkyl sulphuric acid esters are much more easily prepared, and on the whole they are the better

products. The sulphonation of the unsaturated fatty alcohols such as Ocenol presented considerably greater difficulties but by means of suitable temperature control at very low temperatures it has been possible to prepare the sulphuric acid ester of this material. The products which come on the market are the sodium salts of the sulphuric acid esters,

$$C_nH_{(2n+1)}OSO_2ON_a$$

in various physical forms and concentrations.

Amongst the sulphonated saturated fatty alcohols the wetting-out and penetrating properties in the cold are greatest round about C_{12} and decrease slowly as we approach C_{18}. On the other hand the detergent and cleansing powers increase slightly, as does the " fatty " characters of the body, with an increasing number of carbon atoms. Resistance to lime salts decreases slightly with increasing number of carbon atoms, but even at C_{18} it is quite ample. For general purposes, sulphonated Lorol is the best; the sulphonated Lanette wax is mainly used for finishing and avivage purposes. Sulphonated Ocenol naturally does not conform with the graduated properties of the saturated group. It has excellent wetting-out properties, a very enhanced calcium resisting power, fine cleansing powers and extra good " fatty " characteristics.

Varied Applications in Textile Work

A considerable amount of work has appeared in German textile and chemical journals on the special uses of sulphonated fatty alcohols in the textile industry. In wool dyeing, for instance, a small quantity of sulphonated alcohol ($\frac{1}{2}$ per cent.) added to the dye bath gives a finer degree of penetration. If wool is not too dirty it is even possible to scour and dye in the same bath. The sulphonated alcohols are also extremely useful in acid dyeing, chroming, chrome liquoring, vat dyeing, etc. They are valuable in milling, as they give a soft and full handle; they can also be used to help in the felting of wool. In wool washing their emulsifying power is so great that they can completely remove all the ordinary wool greases and waxes. They do not, however, completely de-fat the wool, but in a rather remarkable way the extracted wool greases are replaced by a film of the sulphonated fatty alcohol. As the sulphonated fatty alcohols, contrary to natural wool fats, cannot become rancid, this is also a valuable property.

Whilst the fatty alcohols were originally produced with an eye to their sulphonation, it has since been found that they, themselves, possess valuable properties and are already being used by consumers in very considerable quantities. It has been found, for instance, that Lanette wax, that is to say the technical mixture of C_{16} and C_{18} alcohols, in conjunction with soap, can be used to make paraffin-wax emulsions for waterproofing. The Deutsche Hydrierwerke A.G., however, have prepared a specially treated form of Lanette wax, namely, Lanette wax " U," which disposes of the use of soap and makes direct emulsification of the Lanette wax and water possible. For certain finishing and avivage purposes Lanette wax and paraffin emulsions are also being used as well as Lanette wax and olive oil or cocoanut oil emulsions. Such emulsions give the filament a soft pliable feel, specially in the case of artificial silk mixtures.

The Chemical Outlook in America

Research Weathering the Depression

CHEMICAL research in America has escaped the devastating influences of the depression, according to a survey of the economic position of the chemical industry in *Industrial and Engineering Chemistry*, published by the American Chemical Society. Mindful that those corporations which retained their scientific organisations during the slump of a decade ago were the leaders in the prosperity which followed, the industry as a whole has preserved its research staffs in preparation for the upturn which it believes lies ahead.

For this reason, it is pointed out, there is less unemployment among chemists than among other professional groups. Establishment of the six-hour day in the industry has stretched the pay rolls over a greater number of workers. Several instances of courage in launching new enterprises are reported in the survey. One concern even increased wages. It would be unjustifiably optimistic to anticipate that we are going forward to any such period of artificial prosperity as characterised the years preceding 1930, it is stated, but one may also discount the dismal prophecies of others who see nothing but thick gloom ahead for many years to come.

Unemployment

Among chemists and chemically trained workers of what might be considered professional standing, the extent of unemployment has been small compared with other groups, presumably because the last decade has firmly implanted the lesson of 1921 in the minds of executives. In 1921 research departments were still considered more or less extraneous to the real business of manufacture and sale of commodities, and consequently were jettisoned at the first indication of a storm. In the period that followed, business battles were won so consistently by the best research organisations that this activity has now been closely integrated into an essential position in corporate structures. At the same time men with research training have risen to posts of responsibility in corporate affairs so that research workers now have friends at court in a way that they did not have before.

Consequently, during the present disturbance, research has occupied a preferred position. While production and even sales forces suffered in 1930, research staffs were held practically intact well into 1931, and even then were pruned with great caution. Although there have been exceptions to this rule, generally the reduction of research forces has been a pruning process rather than a deforestation. Under such circumstances it is gratifying to find that the membership of the American Chemical Society shows a relatively low percentage of unemployment.

To assist in re-employment, local sections of the Society are organising and operating committees made up of the unemployed themselves to assist in the problem of finding and creating openings. The New York and North Jersey sections, where conditions are worst, are leading in this movement.

Four New Ventures

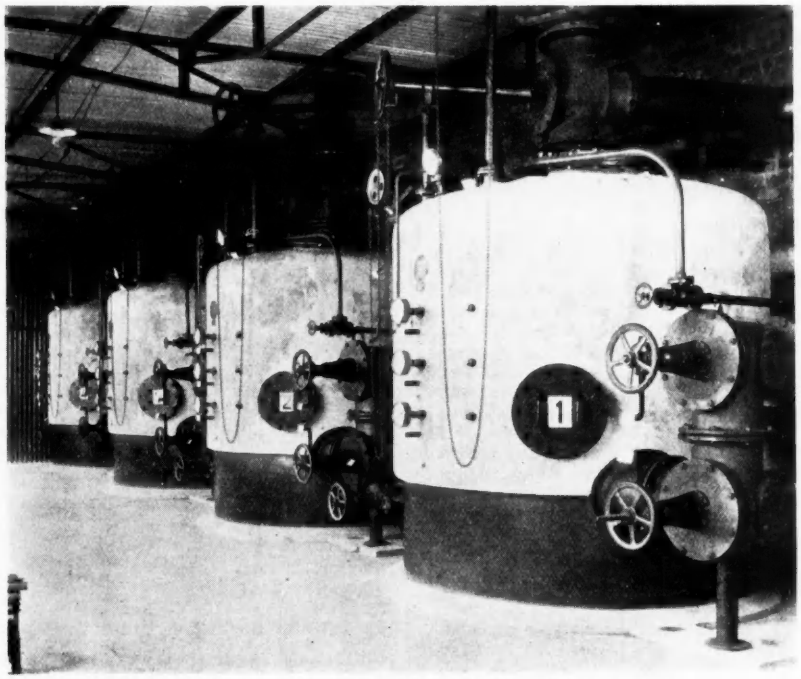
Four new ventures launched into commercial reality against the tremendous industrial inertia of 1931 stand out as clear indications of the courage of their promoters.

The United States Potash Company, a subsidiary of the Pacific Coast Borax Company, put into operation early in the year its mine near Carlsbad, New Mexico. This mine, the only shaft mine operated for potash in America yields sylvite (potassium chloride) from a depth of 1,200 to 1,400 ft. of sufficient purity for sale as manure salt, after simple grinding and without concentration.

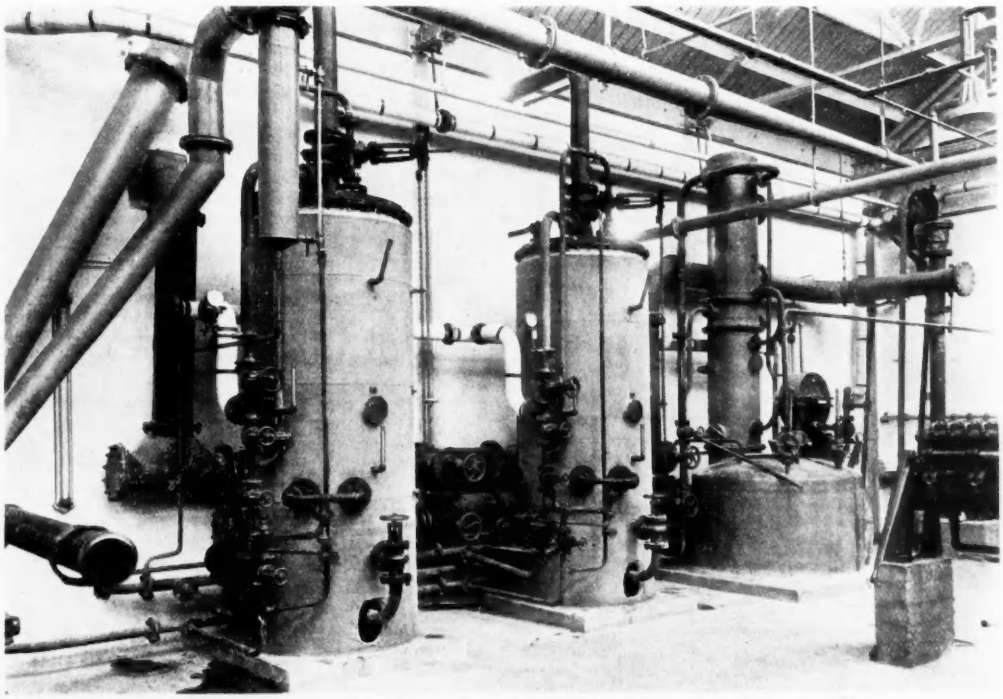
The Southern Mineral Products Company, a subsidiary of the Vanadium Corporation of America, began production of titanium oxide pigments and other chemicals at Piney River, Va., in April. This plant operates on ore locally produced and turns out high-grade pigment. The ore, nelsonite, is an aggregate of ilmenite and apatite containing magnetite, and is obtained from an open-cut mine. In addition to titanium oxide the plant produces phosphoric acid and phosphates.

In November, E. I. du Pont de Nemours and Company announced their new product, "Duprene," a synthetic rubber. This material is being produced at Deepwater Point, N.J., in commercial quantities. Its present field of usefulness depends upon its resistance to water and hydrocarbon solvents suggesting its utilisation in hose, rubber valves, etc., for such liquids. Further applications are to be expected. The finished product contains chlorine and requires no sulphur for vulcanisation. The fundamental work on which this development is based was initiated and conducted by and under the direction of J. A. Nieuwland of the University of Notre Dame. In connection with this development, it is interesting to note that a small piece of synthetic rubber, believed to be the first ever to be made from petroleum as a raw material, was exhibited by the American Chemical Society at the 1931 Chemical Exposition.

The fourth commercial development of special interest was the beginning of operations by the Standard Chromates Company, at Painesville, Ohio, manufacturers of sodium dichromate.



An Installation Recovering Mixed Solvents in a Scottish Leather Cloth Factory.



A Small Recovery Plant in Operation at a London Dry Cleaning Works.

Solvent Recovery by the Bayer Active Carbon Process

(By Courtesy of British Carbo-Union, Ltd.)

Economic Conditions in German Chemical Industry

Position Regarded with Optimism

Conditions in the German chemical industry from the middle of 1930 until the summer of 1931 are reviewed in an important section of the "Report on Economic Conditions in Germany" by J. W. F. Thelwall, Commercial Counsellor, and Mr. R. P. F. Edwards, Commercial Secretary to H.M. Embassy, Berlin. The following extracts are taken from the Report, which is issued by the Department of Overseas Trade (H.M. Stationery Office, 4s. net).

THE German chemical industry suffered the first set-back for six years owing to the continued depression among its principal consumers, the textile, building and agricultural branches. There was, however, an improvement in the first six months of 1931 and the position was regarded with optimism. German chemical exports declined in value by about 17 per cent. in comparison with the figures for 1929, but the decrease was largely due to the international agreement regarding nitrogen fertilisers, the foreign trade in which declined by some Rm. 100 million. Otherwise, sales were on the whole well maintained. The lower figures for dyestuffs were not as pronounced as the falling off in the textile trade.

The following table shows the principal exports :—

	1926	1928	1930
	(Rm. million)		
Heavy chemicals	234·7	259·8	251·0
Charcoal products	13·8	16·8	14·9
Nitrogen fertilisers	205·5	280·0	188·9
Phosphorus fertilisers	10·6	12·7	9·9
Coal tar dyes	216·5	236·7	196·4
Mineral dyestuffs	84·9	95·4	99·8
Paints and varnishes	10·3	20·7	21·8
Explosives and munitions ..	25·6	27·3	24·2
Pharmaceuticals	93·9	119·9	122·5
Essential oils and perfumes ..	16·7	20·0	18·6
Cosmetics	11·2	14·8	13·1
Glue and gelatine	13·6	14·9	20·4
Tanning extracts	3·7	4·6	5·5
Rayon	32·8	69·2	64·8
Moulding materials	19·3	30·8	26·2
Photographic materials ..	31·9	46·2	48·2
Other chemical products ..	36·8	48·8	54·0
Total	1,061·8	1,318·6	1,180·4

German Dye Trust (I. G. Farbenindustrie)

The annual report for 1930 stated that turnover and profits earned had been affected by the general economic crisis. Exports of dyestuffs from all countries declined by about 10 per cent., but the German proportion of total sales was somewhat higher. An improvement in market conditions in the Far East was attributed to working agreements with the French and Swiss chemical industries. For inorganic chemicals, solvents and light metals, improved manufacturing methods and new uses largely compensated for the lower demand and in some cases sales increased. The position as regards pharmaceuticals and insecticides was satisfactory and considerable progress took place in sales to various foreign countries. The output of perfumes was maintained at the level of 1929, while business in photographic materials, which developed up to expectations in Germany, was extended in overseas markets. The quantity of rayon sold remained at the preceding year's figures. The staff of the firm at the end of 1930 numbered 79,963; including associated mines and works the corresponding figure fell from 131,752 in 1929 to 114,197 in 1930. From October, 1930, onwards, sales of chemicals and dyestuffs were concentrated at Frankfort, the sales offices for pharmaceuticals and insecticides remained at Leverkusen and for photographic materials, rayon, perfumes and fertilisers in Berlin. The output of associated firms decreased as follows in 1930 against 1929 :—Coal from 1,148,982 tons to 1,063,994 tons, coke from 508,709 tons to 450,981 tons, lignite from 20,289,467 tons to 15,996,486 tons. Depreciation accounted for Rm.57 million, as against Rm. 70 million in 1929, the net profit was reduced from Rm.110 million to Rm.89 million, out of which a dividend of 12 per cent. was again declared on ordinary share capital; the latter amounts to Rm.714 million; shares with a value of Rm.87 million were withdrawn during the year.

The I.G. Chemie, Basel, the Swiss holding company for the foreign interests of the German Dye Trust, was able to pay a dividend of 12 per cent. without resorting to the guarantee given by the Trust. The American I.G. Chemical Corporation, New York, had a net profit of 2,323,000 dollars, which was placed to reserve.

Nitrogen

In August, 1930, an international nitrogen convention was formed, comprising, together with the output of lime nitrogen, over 98 per cent. of the European nitrogen production and, with the Chile saltpetre industry, about 80 per cent. of the total capacity in all countries. It was estimated that output in the years 1928-29 and 1929-30 amounted to 2.1 and 2.2 million tons respectively, while consumption in the corresponding periods was only 1.9 and 2.0 million tons. Stocks in June, 1930, were given as 800,000 tons. Production of the convention members was fixed at 1.1 million tons, of which 840,000 tons were allotted to Germany, Great Britain and Norway together. The agreement was arrived at provisionally for one year and efforts to obtain an extension for ten years were unsuccessful in July, 1931. The German Ministry for Economic Affairs made provision, by the introduction of heavy duties, against the flooding of the home market with foreign nitrogen products. Apart from the effect of the regulation of the market by international agreement, agricultural depression had a serious influence on nitrogen sales. Exports in the past few years were as follows :—

	1927	1928	1929	1930
	(Metric tons.)			
Nitrate of soda	60,276	32,421	69,411	65,196
Nitrate of potash	21,243	23,161	28,534	26,000
Sulphate of ammonia ..	669,880	837,257	726,813	463,682
Lime nitrogen	563	303	1,264	6,353
Nitrate of lime, urea ..	268,504	395,586	494,336	308,982
Estimated total content of pure nitrogen	192,000	242,000	244,000	160,000

The heavy decrease in 1930 is partly accounted for by the reduction in reparations deliveries to France. Imports of sulphate of ammonia, which in 1928 and 1929 were only about 200 tons per annum, rose in 1930 to 44,760 tons, half of which was from Poland. The home demand for nitrogen fertilisers in the first six months of 1931 was higher than a year ago and sales abroad were described as satisfactory. The Nitrogen Syndicate issued a new price list for the export trade in July, 1931, in which quotations for nitrate of lime were reduced by 10 per cent., and for sulphate of ammonia by 35 per cent.

Potash Industry

The German potash industry was relatively well situated during the crisis of 1930. Sales were maintained at the previous year's level up to the end of October. The official price reduction campaign was largely responsible for the backward attitude of consumers in November, when turnover suffered a heavy decline, while in December demand again improved considerably. Sales for the year amounted to 1.36 million tons of potash salts (K_2O), compared with 1.40 million tons in 1929. The total value of the turnover, including by-products and sundry revenue, was estimated at Rm.250 million.

The reduction in sales, amounting to 44,700 tons was largely due to lower consumption in Germany, where the depressed position of agriculture received the attention of the Government as well as of the Potash Syndicate. The new sales conditions from December 1, 1930, granted considerable advantages to consumers, particularly in regard to freight charges over long distances, and for orders placed before December 22, 1930, special rebates or discounts were allowed.

Sales from January to June, 1931, amounted to 624,267 tons of potash salts, compared with 829,230 tons in the corresponding period of 1930. Exports of potash fertilisers in 1930 amounted to 991,684 tons, valued at Rm.60.06 million, which figures are 8 per cent. in quantity and 10 per cent. in value less than in 1929; the decrease was almost entirely due to reduced exports to Poland.

During the past year, potash production was again carried out by about 40 mines and 30 works, which, it was estimated, were employed at 70 per cent. of their capacity. There was little change in the output quotas of Potash Syndicate members, apart from an allocation of the participation held by two mines of Preussag, which were closed owing to being flooded, and a slight increase granted to a Burbach works. A reassessment of members' quotas, which should have taken place by January 1, 1934, according to syndicate statutes, was postponed until December 31, 1943, by a decree of the German Minister for Economic Affairs.

The dividend policy of the principal groups has not been uniformly influenced by market developments. The Burbach concern has again declared a dividend of 12 per cent., the Wintershall Works have decided to reduce their dividend from 12 per cent. in 1929 to 8 per cent. for 1930. The Salzdetfurth group also decided to pay a dividend of 15 per cent. on Salzdetfurth shares and 10 per cent. each on the shares of Aschersleben and Westeregeln as in 1929.

Artificial Silk Output

The output of the German rayon industry in 1930 was estimated to have undergone a slight reduction in comparison with 1929, when production was given as about 25 million kg. Internationally, Germany advanced from the fourth to the third most important producer of rayon, after the United States and Italy. Although the world market suffered from a general slump, the demand for rayon within Germany rose by more than 20 per cent. to over 30 million kg. The percentage of trade union employees working full time in the silk and rayon industries fell from 61.7 per cent. in January to 56.8 per cent. in April, 52 per cent. in June, 49.3 per cent. in October, 1930, and 32.5 per cent. in January, 1931, rising again to 38.8 per cent. in April; the average for 1930 being 51.7 per cent. as against 74.4 per cent. in 1929 and 91.7 in 1927. The trade revival in the spring of 1931 was greater than usual and output in some branches in the first six months was stated to be twice as high as in the corresponding period of 1930.

The keen competition for the German market is demonstrated by the development of rayon imports. Imports of all kinds of rayon yarns showed a further increase from 9,353 tons with a value of Rm.66.25 million in 1929, to 11,675.2 tons with a value of Rm.76.1 in 1930, the chief exporters to Germany being Italy and Holland. Exports declined from 8,99. tons valued at Rm.90.5 million in 1929, to 6,962 tons valued at Rm.64.7 million in 1930, the principal importers being Czechoslovakia, United States and Spain, so that an excess of imports over exports in 1929 to the extent of 359 tons and a value of Rm.24 million in 1929 was increased to 4,713 tons and a value of Rm.11.5 million in 1930. The average price of rayon yarn imported fell from Rm. 6.97 per kg. in 1929 to Rm.6.44, while the price of exports fell from Rm.10.10 to Rm.9.24 per kg. For the quarter ending March, 1931, imports of rayon yarn amounted to 2,247 tons valued at Rm.13.4 million, compared with 2,784 tons for the corresponding period of 1929, and exports to 1,364 tons valued at Rm.9.9 million, as against 2,045 tons in the first quarter of the preceding year.

Sales Organisation for Viscose Silk

In April, 1931, discussions were commenced between German manufacturers and representatives of Italian, Dutch and Swiss producers regarding the German market for viscose rayon. It was proposed to form a sales company to control the import of foreign rayon and to allot quotas. Special importance was attached to these negotiations, in which the I.G. Farbenindustrie was again induced to discuss a basis of agreement with the Vereinigte Glanzstoffabriken A.G. Prices were raised between 5 per cent. and 10 pr cent. Finally a number of firms signed an agreement whereby the whole of their sales of viscose silk within Germany were entrusted to a common sales organisation, the "Kunstseide-Verkaufsbüro G.m.b.H." Berlin, for a period of 10 years from September, 1931. French and Belgian firms, who supplied about 10 per cent. and 11 per cent. respectively of German rayon imports in 1930, did not become partners to the agreement. A certain quantity of the import from France and Belgium was, however, acetate silk, so that, after allowing 5 per cent. for imports from other countries, it is estimated that over 75 per cent. of German rayon imports and almost 90 per cent. of the total German consumption of rayon will now be controlled by the new syndicate.

Tar and Pitch

The production of tar and pitch in Germany was slightly lower in 1930 than in 1929; the actual figures for 1930 are as follows:—

	Coal tar. Tons.	Pitch. Tons.
Total production in Germany	1,450,000	750,000
Production in the Ruhr	1,095,000	600,000
Controlled by the Verkausvereinigung fuer Teererzeugnisse at Essen ..	960,000	530,000
Manufactured by outside firms in the Ruhr area	135,000	70,000
Production in Eastern Germany .. (Controlled by the Teerprodukten-vereinigung des Ostens in Berlin)	190,000	100,000
Production in Southern Germany .. (Controlled by the Nebenprodukten vertrieb at Frankfort)	45,000	25,000
Production of tar in gas factories in Germany (estimated)	120,000	25,000

While prices of tar and pitch products were falling in 1930, market conditions for pitch were satisfactory under the circumstances. Increasing quantities of this product are required for the production of so-called pitch coke, which is used for the manufacture of electrodes. Prices of tar and pitch rose as from May, 1931, presumably as a result of the restricted output of these products. While the import of these products, with the exception of light and heavy coal tar oils, hydrocarbon and asphalt naphtha, decreased in 1930, import figures for tar, pitch, aniline and hydrochloride of aniline went up during the first six months of 1931. The only remarkable increase in exports was for pitch in 1930.

Benzol

The German production of benzol in 1930 is put at about 333,000 tons, as against about 360,000 tons in 1929. As from May 29, 1931, the customs duty on benzol, petrol and a number of other light mineral oils was increased from Mks.10 to Mks.17 per 100 kg. This factor, together with the re-formation of the cartel regulating the sale of all motor spirit in May, 1931, which has ceased to exist in September, 1930, accounts for the higher price of benzol as from June, 1931. In 1930 a new method for the cleaning of benzol had been developed, as a result of which it is expected to reduce the losses during the washing process by between 8 per cent. and 10 per cent.

Synthetic Nitrogen

At the end of 1930 there were six plants in the Ruhr area manufacturing synthetic nitrogen with a total capacity of 170,000 tons: five plants were in operation. Their output of nitrogen products is marketed by the German Nitrogen Syndicate on the basis of an agreement concluded as from July 1, 1930, for the duration of seven years and providing for a total quota of 110,000 tons in 1930, of 140,000 tons in 1931-32 and of 160,000 tons as from July 1, 1932.

The nitrogen plant of the Mont Cenis mine has been leased by the I.G. Farbenindustrie A.G. and is only used for production on an experimental basis. The new plant of the Ewald mine was completed in October, 1930. It uses the process of the American Nitrogen Engineering Corporation (200 atm. pressure). Though in July, 1931, only 35 per cent. of the quota could be utilised it was stated that the interest on the capital invested was earned and that the plant, together with the cokery, the gas of which serves for the production of hydrogen, should be kept going. The Koenig Ludwig mine is supplying the coking coal, and both the Ewald mine and the Koenig Ludwig mine are to be linked up to the grid of the Ruhrgas A.G., through the new pipe line Dortmund-Gelsenkirchen. Owing to the situation of these mines it had hitherto been impossible for the Ruhrgas A.G. to utilise the surplus of coke oven gas and this was the reason for the building of the nitrogen factory.

Cyanamide in France

THE Société des Produits Azotes reports that cyanamide sales during 1930-31 declined considerably owing to the depressed agricultural situation and unfavourable weather. Produits Azotes has rented plants producing calcium carbide, syanamide and ferro-alloys, from the Cie. d'Electricité Industrielle de Marignac. The power produced at the Gentille plant of the Société des Forces Hydro-Electriques du Comminges, which began operating in May, is consumed by the Lannemezan cyanamide plant of Produits Azotes.

Earth Colours and their Varied Qualities

By W. Armstrong Storey

At the monthly meeting of the Oil and Colour Chemists' Association held in London on January 14, Mr. W. Armstrong Storey read a paper on "Earth Colours," extracts from which are given below. Mr. Noel Heaton, President of the Association, presided.

THE most important earth colours are iron compounds or a combination of iron and manganese compounds. Other earths which had been used by virtue of their colour were either scarce, and hence economically unimportant, or had been superseded by artificially prepared colours of a similar nature; for instance, ultramarine had now replaced natural lapis lazuli, and vermilion had replaced natural cinnabar. Those earths which are most commonly met in commerce were divided rougly into the ochres and siennas (raw and calcined); the red oxides; the umbers and the blacks. The Board of Trade returns of imports into the United Kingdom gave only a rough idea of the varying importance of the sources of earth colours from outside the United Kingdom. The most important ochres were the French, followed by the United States and Germany. Italy sent siennas and some umber, whilst there was the new South African ochre, the Indian ochre and some Spanish ochres. The Persian imports and the bulk of the Spanish imports were red oxide, whilst some part of the United States and German imports also represented red oxide.

French and American Ochres

By far the largest production of ochre takes place in France, the total exports from that country for 1930 being 34,680 metric tons. The bulk of the finished ochre is exported through the port of Marseilles. The industry was at one time entirely and is to a great extent still, in the hands of farmers who treated the production rather as a side line and as a seasonal occupation. The ore, after digging, is carefully selected by colour and thrown into a series of basins from 9 ft. to 15 ft. square made by damming back small streams. The levigated ochre pulp was then allowed to settle in these basins for several months and when a stiff mud had formed the water was drained off and the ochre cake dug out and dried in covered sheds during the summer months. The mud ochre was then powdered by hand by means of a large pestle and put through hand sieves. Now, however, there are a number of factories working on economic lines, the semi-natural ponds being replaced by concrete vats 45 ft. to 600 ft. square, and the laborious hand sieving is replaced by modern mechanical methods. The colours of the French ochre range from the palest citron to deep orange.

The American ochres are the so-called light and dark Peru ochres. The getting of the ore in this field is very different from the method adopted in France because it contains from 30 per cent. to 40 per cent. of ochre mixed with quartzite, clay, sand and barytes. The ore is passed over a "grizzly" to remove the large pieces of quartzite rock, and water, under pressure, then disintegrates and washes away the softer ochre to a log washer about 20 ft. long. The coarse discharge from the log washer is raked over a screen and passes under water sprays to remove the last of the ochre before the sands are finally discharged as waste. After the ochre pulp has been classified to remove the remaining sands it is discharged into a Dorr thickener, dried and taken to the grinding plant.

Red Oxide of Iron

The red oxides of iron, although lacking the great variety of shade seen in the ochres and siennas, are the most important of all from the point of view of quantity produced. They include the Spanish reds, Persian Gulf red and a few English, American and Canadian reds. The most important source of red oxide is Spain, where the vast beds of hematite mined for iron and steel production, have deposits of bright red ore suitable for colour manufacture, disseminated through them. These beds are very compact and are generally loosened by explosives, the different grades of oxides being carefully selected by hand picking into three qualities. The manufacture of both the oxides and the ochres in Spain is still carried on, for the most part, by the old method of water levigation but other methods are now in use in some factories especially for the purer carefully graded ores. Preliminary crushing is given in edge-runners and the fine grinding is carried out in large mills in conjunction with air flotation.

Another important source of red oxide is the island of Ormuz or Hormuz, in the Persian Gulf, the imports from this source being nearly as great as that of the Spanish reds. This oxide is rather lighter and sandier than the Spanish ores and is consistently lower in ferric oxide. There are also a few important English reds among which must be mentioned the Winford red oxide from Somerset, and Forest of Dean red oxide from Gloucestershire. The latter appears to be somewhat irregular in the way it is deposited and shows considerable variation, but the better grades are of a fine fiery red colour approximating to the Persian Gulf red.

The overseas ochres of importance include Indian ochre, which is soft in texture and light in gravity with better staining power than the average French ochre, and the new South African ochre, of which 16,046 cwt. was imported in 1929, as compared with only 10 cwt. in 1925. The latter is somewhat similar to the Indian and some French ochres in shade but is possessed of a considerably greater staining power and ferric oxide content.

Although the occurrence of umber is widespread throughout the world, practically the whole of the umber of commerce comes from the island of Cyprus. Here it is quarried and a large proportion of it is calcined before export. It varies considerably in composition the ratio of manganese to iron increasing as the shade deepens. In extreme cases, where the iron becomes almost completely replaced, it is about identical with black MnO_2, but the MnO_2 of commerce comes chiefly from Causcasus, India, and South Africa, the first variety being considered the most valuable for colouring purposes.

Points from the Discussion

MR. H. D. BRADFORD pointed out that the author had not mentioned oxide which was found in Turkey and Asia and was considered to be the tailings from the washing which had been done by the ancients. Neither had he mentioned the hematite oxides of Cumberland. There were many cases where residues were thought to be of value. For instance, some years ago it was thought that the deposits of pit ash, of which there were many thousands of tons in the colliery districts would be useful for making paint. Crawshay's red was one of the finest reds ever put on the market and many years ago it was sold at prices which were about on a par with present prices. It contained slightly over 95 per cent. of oxide of iron and a curious thing about it was that it contained a small percentage of carbonate of lime.

THE PRESIDENT said he had always wondered why the supply of Crawshay's red had been stopped. He believed there were vast deposits of Crawshay's red left in the mine. This red was a magnificent oxide and why was it that practically all our iron oxides to-day were imported. He had never thought that the Spanish oxide was so much better than the deposits we have in this country and it would be interesting to know why our own deposits had not been developed to a greater extent.

MR. S. W. KENDALL, speaking with regard to the conversion of metallic iron to oxide pigment, said there is in operation in America to-day a large scale process which depends upon dissolving the iron in water, air and CO_2 being blown through in carefully measured proportions, the concentration of the liquid being also carefully controlled. This produced oxides varying from pale lemon yellows to deep purples and it was quite conceivable that some of the natural iron ores might in some way have been reduced to the metallic state and then converted into the form of reds and purples.

DR. L. A. JORDAN discussed the changes that take place in the specific characteristics of iron oxides under the influence of heat treatment and said that whilst he did not wish to depreciate the importance of chemical impurity, the physical attributes of these materials had a very important bearing on their paint making properties.

The Preparation of Emulsions

By William Clayton, D.Sc., F.I.C.

Dr. Clayton is well-known as an authority on the subject of emulsions. The following paper, read before the Chemical Engineering Group of the Society of Chemical Industry, January 15, is especially informative, particularly to those engaged in branches of the food industry, in which emulsions play a definite rôle.

WHEN two pure immiscible liquids are shaken together or otherwise violently agitated, a temporary but very unstable emulsion is produced. When agitation ceases, the liquids rapidly separate. Two quite pure liquids cannot form an emulsion, except of great dilution (oil hydrosols), and even so, no emulsion of water drops in a pure organic liquid has been recorded. To prepare a stable concentrated emulsion of oil-in-water or water-in-oil, it is essential to have present a third substance capable of functioning as an emulsifying agent. According to the newer ideas the mechanism of this emulsifying action is intimately linked up with surface films, molecular orientation, and interfacial tension.

Emulsifying agents fall into two classes, those capable of stabilising emulsions of oil-in-water, and those which stabilise emulsions of water-in-oil. Again, for either type of emulsion, emulsifying agents are known which are present as insoluble finely-divided solids, or in true solutions. In most cases the emulsifying agent surrounds the dispersed globules of oil, or water, forming an adsorbed film or layer, the effect of which is an enhanced stability of the system.

Pioneer Work

The pioneer investigators in this field were Ramsden (*Proc. Roy. Soc.*, 1903, *72*, 156; *Zeits. phys. Chem.*, 1904, *47*, 336.) and Donnan (*Koll. Zeits.*, 1910, *7*, 208), working along entirely different lines. Ramsden's work began with the frothing of solutions, a phenomenon well known in colloid systems. Froth or foam represents an enormous film-like area of liquid supported in a gas, usually air. Since the inter-face is now very great, adsorption is pronounced, and Ramsden observed that in certain cases the adsorbed colloid in a frothing solution became so concentrated in the froth as to be " precipitated " in solid or semi-solid lamellæ or membranes. Particularly striking were his experiments with aqueous solutions of albumin, which, on agitation or pouring from one vessel to another, gave a most persistent foam stabilised by solid albumin, irreversibly precipitated from solution.

Donnan arrived at conclusions similar to those of Ramsden by his investigations relating to the interfacial tension between oils and soap solutions. Using the now familiar drop-pipette, Donnan determined the number of drops of oil rising through a solution of caustic soda under standard conditions. The number of drops is, as a first approximation, inversely proportional to the ease or degree of emulsification of the oil in the alkaline solution. Colza oil in pure water had a drop number of 88, whilst in N/1000 NaOH, the drop number rose to 306. With 1.3N/1000 NaOH the drop number was indeterminate, the oil simply streaming through the aqueous phase. Donnan next showed that a pure oil, freed from fatty acid, had exactly the same drop number in water and N/1000 NaOH. Thus, it was apparent that the formation of soap caused the increasing dispersion of the oil in water.

The Emulsion Type and its Limitations

So far no indication has been given of what determines emulsion type. Experience has empirically divided emulsifying agents into two classes: (a) those promoting the O/W type, and (b) those promoting the W/O type. Emulsions of oil-in-water are stabilised by colloids such as gelatin, albumin, lecethin, agar, gum acacia and gum tragacanth, Irish moss and sodium and potassium soaps. Such powders as silica, colloidal clay, kieselguhr and freshly precipitated calcium carbonate, calcium arsenate and basic cadmium sulphate are also effective. Emulsions of water-in-oil are stabilised by gum dammar, cholesterol, calcium, magnesium, nickel and zinc soaps, crude rubber, resin and lanolin. Solids as carbon, soot, asphalt and mercuric iodide also serve. As an empirical rule, Bancroft (*J. Phys. Chem.*, 1914, *17*, 515.) pointed out that emulsions of oil-in-water are stabilised by substances giving colloidal solutions in water, and that substances giving colloidal solutions in oil stabilise water-in-oil emulsions.

There is no geometrical limit to concentration to the amount of liquid which can be dispersed in another liquid using a suitable emulsifying agent. Assuming the dispersed liquid consisted of equal sized globules as spheres, it would follow that the maximum amount capable of being dispersed would be about 74 per cent., at which concentration any given globule would be surrounded by, and in contact with, twelve other globules. Since, however, the liquid globules are deformable and since the film of emulsifying agent assists such deformation, more and more liquid can be dispersed, the globules squashing together. Again, the majority of emulsions contain globules of very varied size, so that small globules can be squeezed into the spaces between the larger ones.

Emulsions of 99 per cent. of oil in water have been prepared by Pickering, and emulsions of 90 per cent. of water in benzene were made by Newman (*J. Phys. Chem.*, 1914, *18*, 45.) using 1 per cent. magnesium oleate as the dispersing agent. Emulsions containing over 80 per cent. of dispersed liquid are extremely viscous; in fact, Pickering's emulsions could be cut into cubes.

General Principle Involved

Emulsification is the art or practice of dispersing a given liquid as more or less permanent globules in another liquid medium, and numerous machines have been devised to secure an intimate subdivision of the disperse phase in the continuous medium. The general principle involved is agitation of the two liquids in vessels which are usually jacketed to permit of temperature regulation by circulating steam, or hot or cold water as desired. The emulsions are usually prepared in batches, although continuous-flow emulsifying apparatus are also in use.

The ideal method of preparing emulsions is that wherein the internal phase is projected in a finely-divided condition inside the main bulk of the external phase out of contact with a gas phase. The whole work of dispersion can thus be made on the internal phase and adsorption at the dineric interface can be reached without the interfering adsorption at the gas-liquid boundary common to the usual agitation of stirring methods. Conversely mixing liquids by means of blowing gas through them, is a faulty and unscientific method, since adsorption is pronounced in the resulting froth and not in the liquid-liquid interface. Indeed, good emulsions may actually be " broken " by agitation alone, the protective colloid or emulsifying agent leaving the oil-water interface by preferential adsorption at the air-water interface.

It is reasonable to believe that for any emulsifying apparatus or machine there exists an optimum speed or degree of agitation or mixing, and an optimum time of running, whereby the most stable emulsion can be attained for a given system. Experiments prove this to be correct. Bechold, Dede and Reiner (*Koll. Zeits.*, 1921, *28*. 7) found that the formation of emulsions of water and organic liquids, using finely-divided solids, reached an optimum after ten minutes standard shaking. Herschel (U.S. Bureau of Standards, *Technological Papers* No. *86*) has investigated the effect of duration of stirring, and speed of agitation, when emulsifying lubricating oils in water. He adopted five minutes as the time for agitation, using an electrically-driven paddle, in all his tests, having found that no marked increase in stability of the emulsions followed longer agitation. He also found that, in general, there is a speed above which the stability of the emulsions decreased. The curve representing the relation between speed and stability passes through a minimum, so he adopted a speed of 1,500 r.p.m. since, on the average, it gave a minimum rate of separation. Under constant conditions of agitation, the graph connecting time with emulsification effected is of the exponential type. The practical significance of such results is obvious, inasmuch as excessive expenditure of power in making emulsions is unnecessary, an optimum working time being readily ascertained.

Interesting work on emulsification has also been carried out by Briggs (*J. Phys. Chem.*, 1920, *24*, 120.) who, thinking that the mode of shaking a mixture of benzene and sodium oleate might be an important factor, found that intermittent shaking

was much more effective than the usual uninterrupted shaking. Briggs concluded that "intermittent shaking may be six hundred or even a thousand times more effective than uninterrupted but equally violent agitation." Shaking by hand, mixtures of benzene in 1 per cent. aqueous sodium oleate, Briggs found that to emulsify 60 per cent. by volume of benzene 750 shakes were necessary, occupying 4.2 minutes. The same mixture could be completely emulsified with 5 shakes in less than 1 minute, if after 2 shakes a rest of 30 seconds was permitted. It was observed that the time required to form a complete emulsion with intermittent agitation passes through a minimum as the rest interval increases. It would appear, therefore, that the ideal process of emulsification is one wherein the dispersed phase is as completely disintegrated as possible, whilst the continuous medium is left as far as possible unbroken.

Effect of Temperature

The effect of rise in temperature is, in general, to make emulsification easier. Reduction of viscosity is obviously a factor concerned. The main interest, however, lies in the relation of temperature to the interfacial tension and the adsorption of the emulsifier at the interface. For non-miscible liquids rise in temperature is usually accompanied by a decrease in the interfacial tension, a condition favourable to emulsification. With an emulsifying agent soluble in one liquid, change of solubility with temperature may introduce complications.

The ultimate stability of an emulsion depends on several factors. Enhancing stability will be (1) fine dispersion of the globules, (2) a minimum difference in the densities of the two phases, (3) a viscose continuous phase, and (4) a stable film around the globules. For the last factor, time may be necessary to permit adequate adsorption of the emulsifying agent, accompanied in some cases by de-solution due to denaturation. We are therefore led to the conclusion that a given emulsifying agent plays two parts: (1) it permits easy dispersion owing to a reduced interfacial tension, and (2) it may promote stability after its adsorption, assuming the absence of disturbing factors such as chemical change or such physico-chemical alteration as leads to syneresis. Reduction of interfacial tension should also render emulsification easier.

The actual mechanism of emulsification is extraordinarily complex. The emulsifying agent serves to inhibit the coalescence of the internal phase and does not necessarily determine the degree of dispersion reached.

Homogenisation

In dairy technology and in the preparation of salad cream the homogeniser is the favourite machine for fine dispersion of an already prepared emulsion. By means of three or six pistons working successively by the aid of shaft eccentrics, the emulsion is forced under great pressure through an homogenising valve which usually takes the form of two ground surfaces seating accurately as a drop and lift valve. Well-known types of such apparatus are the Jensen-Andersen, Gardner, de Laval, Manton-Gaulin, and Viscoliser. The emulsion is forced into the homogeniser at a pressure up to 5,000 lb. per sq. in. and the valve through which it must pass is gauged with a strong spring which allows a valve clearance of only a few thousandths of an inch. The seating and unseating of the valve takes place with greater frequency, the emulsion passing through the opening with a velocity up to 25,000 ft. per sec.

Homogenisation produces a great increase in the viscosity of an emulsion, due to the enhanced adsorption of emulsifying agent at the newly-formed extensive oil-water interface. It is significant that the second stage homogenisation greatly reduces this viscosity. No adequate explanation has yet been proposed to account for the phenomenon of globule clusters. Investigations should be carried out with a given oil and water, using quite different kinds of emulsifying agents such as solid powders, gums, and proteins, so that variations in the nature of the adsorbed layer may be explored in relation to the incidence and magnitude of clustering.

Points from the Discussion

MR. T. MCLACHLAN, discussing the question of whether or not it was necessary to allow air to get into an emulsion when using a colloid mill, said he had found that, given a proper arrangement of the pipes, the introduction of air into an emulsion prepared in a colloid mill could be obviated, and under those conditions one could obtain a very fine emulsion indeed. Another point which occurred to him was that if solid particles were to form an emulsifying agent for an emulsion they had to be wetted, and it had occurred to him that when the solid particles were wetted they were actually hydrated.

MR. A. STEWART asked Dr. Clayton if he had ever considered the possibility of putting emulsions through a colloid mill a number of times. His own experience was that to pass an emulsion through a mill more than once did not result in a very pronounced increase in the efficiency of emulsification. With regard to Dr. Clayton's suggestion that there was some doubt as to the best viscosity to use, and the best speed of agitation, Mr. Stewart suggested that that was connected with the work that must be done to mix an oil with water and to reduce the oil to the desired particle size. If one had a slow mixer, then in order to do that work it was best to use the emulsion as thick as possible. For example, in making an emulsion of spindle oil with potassium soap it would be better to have a slow mixer or paddle to get the emulsion to the state of the Pickering emulsion, and then a few stirs would break down the globules to the desired extent.

Dispersing Agents

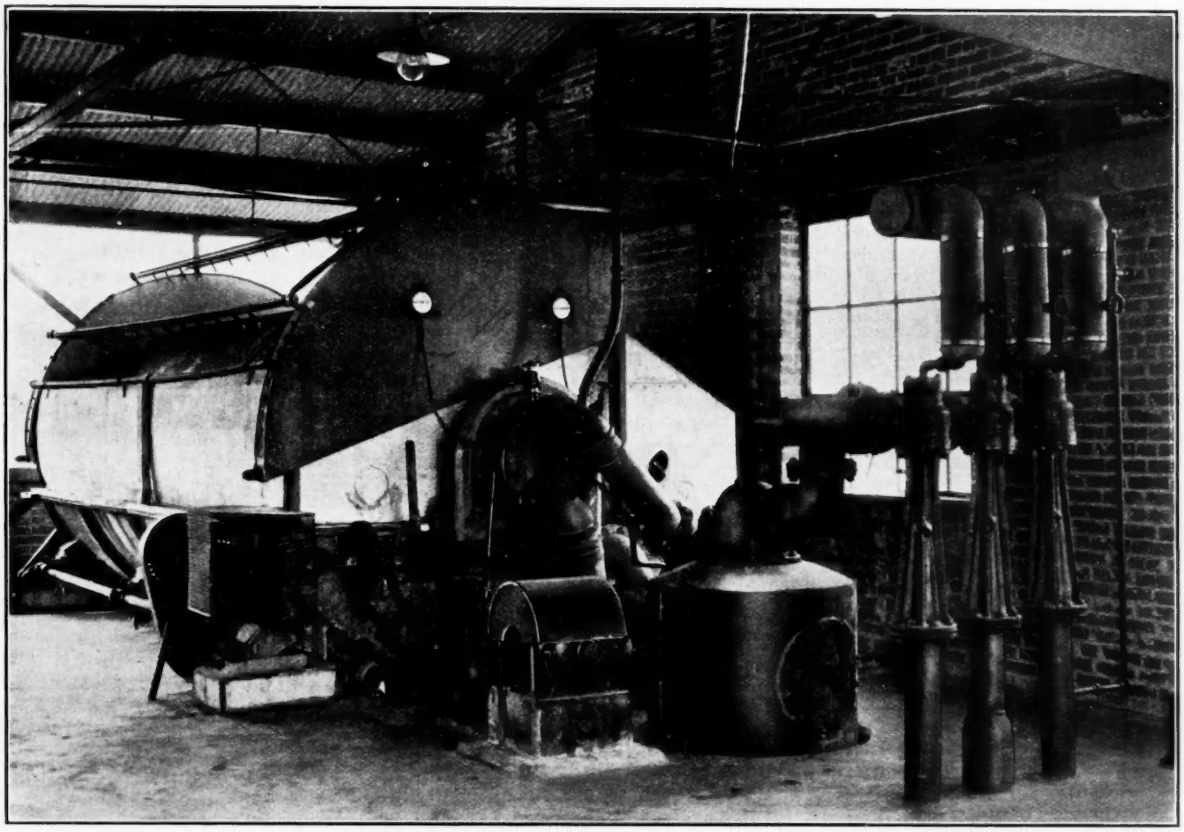
MR. W. H. STEVENS, discussing mixed dispersing agents, referred to a statement that gum tragacanth and gum acacia had given a satisfactory dispersion, whereas when apple pectin had replaced the gum tragacanth and gum acacia the dispersion was unsatisfactory, in that it had creamed. He asked if it were always the case that a dispersing agent of a different type upset a dispersion which had already been prepared satisfactorily. Referring to rubber latex, which was a natural dispersion, dispersed largely with protein substances, he said that when a solution of gum tragacanth was added, the latex creamed much more rapidly than it did normally. Previously he had attributed this to the gum tragacanth having increased the viscosity of the dispersed medium so that the Brownian movement of the particles was seriously interfered with to the extent that the gravity effects played a greater part and the light particles rose to the surface.

DR. CLAYTON, replying to Mr. Stewart, said that if an emulsion were re-passed through a colloid mill, there being a time interval between each passage, it was not equivalent to Briggs' intermittent shaking process, because Briggs' intermittent shaking concerned the actual preparation of the emulsion from the commencement, wheras an emulsion already made by some machine and then passed through a colloid mill was in a totally different condition.

Replying to Mr. Stevens, in regard to the creaming of latex he said it was undoubtedly right that the increased viscosity of the continuous phase played some part, but his own opinion was that we must look for changes in the character of the emulsifying film around the globules. It was quite conceivable that the emulsifying agent in the first instance in latex was of a protein nature, and until investigations proved the contrary he felt that there was a preferential shifting of emulsifying agent at the interface, with the release of a certain amount of the initial or protein emulsifying agent.

Coming New Book by Sir Ernest Benn

FEW books have more clearly revealed to the man in the street what is involved in extravagance in the national expenditure than *Account Rendered*, the publication of which awakened keen interest in the Friends of Economy Movement, of which Sir Ernest Benn has been the leading spirit. Sir Ernest is now hard at work on a new book, which should be the more useful in view of what has happened since *Account Rendered* was published some eighteen months ago. In view of those developments it seems probable (says the *Morning Post*) that the author will this time have something also to say with regard to reparations and international debts, for one of the features of the past twelve months has been the spread of the economic crisis all over the world. Sir Ernest Benn's new book, therefore, will be awaited with a good deal of interest. But while any comments upon the international aspect of the economic crisis will be read with interest, it may be hoped that Sir Ernest will continue to insist upon the need for drastic economy in the national expenditure at home, for the need for such economy will be urgent for some years to come.



This illustration shows one of the operations in the manufacture of caustic soda liquor by the causticising process. The continuous rotary vacuum filter is dealing with causticiser residues—the sludge of calcium carbonate which is obtained as a by-product when the crude sodium carbonate liquor is treated with lime. The clear caustic liquor leaving the filter is evaporated to a strength of 90° Tw. for use in soapmaking. The rotary filter was supplied by Oliver United Filters Ltd., of London, who are one of the pioneers in filtration problems. This type of filter is used successfully for materials which require washing with a minimum amount of wash liquor, as the drum can be so arranged that a clean division is made between strong liquor and wash liquor.

The Origin of Petroleum Oils

Decomposition of Marine Vegetation

THE conversion of algæ into bitumen and petroleum was discussed by Mr. J. E. ; Hackford at a meeting of the Institution of Petroleum Technologists held in London on Tuesday, January 12. Introducing his subject, Mr. Hackford said that no facts supporting the suggestion that oils are produced by the natural decomposition of algæ have yet been brought to light, nor indeed, has oil been produced from algae in a manner in any way similar to processes, or under conditions resembling, those obtaining in nature. It has, however, possible to establish (1) the formation of oil from algæ by processes similar to those obtaining in nature; (2) the presence of the decomposition products of algæ in both naturally occurring oils as obtained from wells, and also from seepage oils and bituminous deposits; (3) the reconversion of oils, various oil seepages, and some seepage products into bodies closely resembling, and in some instances identical with the constituents and decomposition products of algæ; (4) the formation of oils and bitumens from sugars and (5) the reconversion of oils into bodies resembling bitumens, which upon hydrolysis yield sugars.

Chemistry of the Decomposition Process

The conclusions drawn were that algæ being partially soluble in boiling water, yield alkaline solutions. These alkaline solutions contain sugars formed by the hydrolysis of the fucosan present in the algæ, and alkaline may be converted into gases by the action of anærobic bacteria. Both bacterial action and oxidation, however, cause a change in the action of the alkaline solution, due to the formation of free sulphuric acid. At this stage the free sulphuric acid becomes the hydrolysing agent, and by its agency the fucosan is converted into sugars and the calcium salts of the ethereal sulphonic esters. The free sulphuric acid decomposes the sugars at low temperatures with the formation of algarite and an unstable variety of polyhydric fatty acids, which easily lose both their acidic radicle and part or whole of their oxygen, ultimately yielding hydrocarbon oils.

The calcium salts of the ethereal sulphonic esters are decomposed by water with the formation of mono- and di-hydric alcohols—free sulphuric acid and calcium sulphate. This continued formation of free sulphuric acid accelerates the hydrolytic process. As the esters disappear the tertiary amines make their appearance, and after this the ammonium salts are formed. These bodies are also unstable and readily yield oil which mixes with the mono- and di-hydric alcohols formed by the decomposition of the calcium sulphonic esters. The mixture of oils thus obtained contains naphthenic acids, organic sulphur and nitrogen compounds, traces of very many of the rarer elements and other decomposition products of the algæ. In fact, the mixture of oils possess the properties of naturally-occurring petroleum oils. The yield of oil and bitumen calculated on the water-soluble fraction of algæ is high, representing a minimum of 10 per cent. of oil and 43 per cent of bitumen.

The Policy of the F.B.I.

Attitude Towards Tariffs

THE Grand Council of the Federation of British Industries at its quarterly meeting last week reviewed the national position and the policy of industry in relation to it, and unanimously endorsed a statement, outlining the principal lines which the Government should follow, in order to assist British industry.

The Federation considers that it is necessary to adopt a national economic policy covering certain points vitally affecting the prospects of industrial recovery, and restates its conception of the main lines of such a national economic policy as follows:—(1) A new spirit of economy in our internal government, covering administration, taxation and expenditure, with the object of restoring the competitive efficiency of the country; (2) a new fiscal system; and (3) a financial, monetary and investment policy mainly directed towards the restoration of industry and to the development of markets for British goods. It urges that the Government must make every effort towards a substantial reduction of direct taxation, so far as possible by a reduction of expenditure, and to this end should reconsider every aspect of national and local government and expenditure.

Objects of a Tariff

The objects of a tariff, the statement continues, are (a) to afford sufficiently effective protection for manufactured goods in the home market to permit of reorganisation in those industries where this is still required and to enable all efficient industries to increase their volume of production and so lower their costs and thus enable them to recapture lost markets overseas; (b) to permit of the widest possible extension of Empire preference through agreements with the Empire with industry accepting duties on food and raw material, or any other measures which may be necessary in order to secure such an extension of preference; (c) to permit of the progressive breaking down of foreign tariff barriers by means of treaties based on mutual concessions.

A full, scientific tariff, devised to attain the objects set out above, would demand careful and prolonged preparation. During the period in which this preparation is taking place a simple *ad valorem* tariff should be imposed with a system of graded duties and a free list. A suitable tribunal should be set up to deal with appeals for relaxation of duties in regard to special classes or quantities of goods where this is required, to avoid any serious dislocation of trade during the continuance of the temporary tariff.

The construction of full scientific tariffs should be done by a Tariff Board of a permanent character composed of men of the highest standing and impartiality. The members of the Board should be removed as far as possible from political influence by the terms and character of their appointment. Their position in regard to freedom from external influence should approximate as closely as possible to that of H.M. Judges. The Board, having constructed the tariff, should supervise its working, recommend any periodical amendments and adjustments which may be necessary, and deal with any cases of abuse of the advantages conferred by the tariff.

Financial Policy

The Federation assumes that no steps will be taken to return to any international standard, at any rate until there is full assurance that it would both serve the industrial needs of Great Britain and the Empire and that its rules would be observed by the other countries of the world. The Government should direct its immediate efforts to building up a British system based primarily on the Empire and secondly on such other countries as desire to come into some system related to sterling, in the hope that this may provide a reasonable measure of stability and prosperity for Great Britain and the Empire and in due course form the nucleus of a new world financial system.

Serious consideration should be given to the advisability of calling an Imperial Monetary Conference at an early date to examine the practicability of establishing Empire co-operation in currency and monetary matters. The aim should be stability of internal prices throughout the Empire to enable the partner nations of the British Commonwealth to secure for themselves the benefits of stable exchanges and of comparatively stable prices within the Empire, and to give by their success an encouraging example to the world.

The policy of Imperial development based upon the extension of inter-Imperial preferences and the establishment of Empire currency co-operation should be assisted by some degree of conscious direction of investment. British overseas investments should be directed to the development of countries which can absorb British goods and repay us by the export of their own complementary products rather than to countries whose products are competitive with our own.

Murder on the Second Floor

Produced by the Bouverie Players

THE Bouverie Players Society (Benn Brothers, Ltd., Dramatic Section) worthily upheld its dramatic reputation on Monday, Tuesday and Wednesday of this week, when its members produced Frank Vosper's three-act mystery thriller, "Murder on the Second Floor" at the New Scala Theatre, London, in aid of the Furniture Trade's Benevolent Association, the Electrical Trade's Benevolent Association and the John Benn Hostel.

THE CHEMICAL AGE contributed in a large measure to the success of the production, for the play was produced under the direction of Mr. H. J. Wrench, who added another distinct triumph to his series of ten Bouverie productions, while one of the principal rôles was filled by Mr. G. P. Grieve, whose interpretation of the character of Hugh Bromilow, a novelist and playwright, was admirable. Bromilow plays opposite Sylvia, a boarding house keeper's daughter, well portrayed by Miss M. Johns, who chides him for his failure to produce popular thrillers and who ultimately discovers, from his authorship of a series of tragedies, that the pattern she has held up to Bromilow is none other than her lover himself. Bromilow and Sylvia were well supported by Miss E. Hammond, Miss D. Lewin, Miss E. Dennis, and Messrs. H. Duck, G. Schreiber, W. McNaught, E. Williams, J. Mactavish, A. Stevens and C. Payne, while the music was provided by the Fleet Street Orchestra, under the conductorship of Mr. G. O. Davies.

The Chemistry of Boiler Water

Co-operation between Power Engineer and Chemist

IN the course of his paper on "The Chemistry of Boiler Water," read at a meeting of the Manchester Section of the Society of Chemical Industry, held on January 15, Mr. H. E. Jones, of the Research Department, Imperial Chemical Industries, Ltd. (Brunner, Mond and Co., Ltd.), Northwich, said that those who had had experience of the operation of boiler plants knew the difficulties associated with the quality of the feed water and realised the inadequacy of the empirical methods formerly used for the control of such undesirable conditions as scale formation and corrosion in boilers. These difficulties were increased by the widely varying nature of available water supplies and by the fact that a method of treatment which gave successful results in the case of one water entirely failed when applied to another.

In recent years, the position had to a great extent changed and power engineers and chemists had co-operated in an effort to place the subject on a rational scientific basis. Although much remained to be done, and certain phases of the problem could not be said to have been satisfactorily dealt with, the progress made since the war had been remarkable. This development was to a great extent due to the realisation of the necessity of a scientific investigation of the subject in view of the more extensive adoption of modern water-tube boilers, which made more exacting demands than boilers of the Lancashire type in regard to the quality of the feed water; also, to the increasing tendency to raise the working pressure of industrial boiler plants and to install boiler plants in modern power stations operating as high as 1,000 lb. per sq. inch.

The Asbestos Industry in Canada

A NEW REPORT on chrysotile asbestos in Canada has been issued by the Dominion Department of Mines at Ottawa. Copies of this Report may be obtained by persons interested on application, either to the Secretary, Office of the High Commissioner for Canada, Canada House, Trafalgar Square, London, S.W.1, or to the Director, Mines Branch, Ottawa.

News from the Industries

Glass Trade

IT IS EXPECTED THAT THE GLASS TRADE will begin to feel the effects of the new 50 per cent. duty imposed on domestic and illuminating glassware, under the Abnormal Imports Duties Act, towards the end of February. This is the view expressed in the quarterly Report of the National Flint Glass Makers' Society. The new duties, it is stated, should see the industry travelling to prosperity and should result in a rapid decline in the number of unemployed glass makers.

Pottery Trades

EMPLOYMENT in North Staffordshire during December showed a decline, and continued bad on the whole, with much short-time working. At Worcester employment continued fair, but some short-time working was reported. At Derby and at Bristol employment was slack. In the stoneware section in Scotland employment was bad. The percentage of insured workpeople unemployed, including those temporarily stopped, was 39.7 at December 21, 1931, as compared with 29.8 at November 23, 1931, and 41.9 at December 22, 1930. Returns from employers relative to short-time working showed that, of 9,050 workpeople employed by firms making returns, 3,960, or nearly 44 per cent., were working on an average about 14 hours less than full time in the week ended December 19, 1931; the amount of overtime worked was very small.

China Clay Industry

THE POSITION OF THE CHINA CLAY INDUSTRY was reviewed in a new year statement by Mr. E. J. Hancock, general manager of Lovering China Clays, Ltd., St. Austell, who said that it is probably true that a tariff against imported paper and pottery may bring prosperity to the paper and pottery industry of Great Britain, and thus increase the sales of china clay in Great Britain, but if at the same time the United States of America, Canada, and the principal customers in Europe and India are unable through business depression to draw normal supplies from this country the result would not be cheerful. Furthermore, as all producers of china clay are now competing among themselves for such business as might be available, should sales be increased in quantity the proceeds of such sales were not likely to more than barely meet the costs of production.

Iron and Steel

A BETTER TONE HAS DEVELOPED in the iron and steel markets, and there has been some improvement in export business, according to the report of the London Iron and Steel Exchange. The uncertainty regarding tariffs and fluctuating exchanges hinders business, but both home and overseas buyers are showing increasing interest in the market. It is reported that stocks are exceptionally low in most of the principal buying countries and that replenishment orders cannot be long delayed. In the home market also buyers have pursued a cautious policy, but the volume of business in this department seems to be increasing. The demand for finished steel products has been brighter. In this department the export demand has steadily improved and, although a proportion of the orders has gone to the Continent, the British makers have been able to secure a fair share.

Lime and Limestone

THE MANY USES OF LIME in industry were touched upon by Mr. W. Woodhouse, F.I.C., chief chemist to the Stanton Ironworks Co., Ltd., in a lecture on "Lime and Limestone" delivered to the Nottingham Section of the Society of Chemical Industry, on January 14, Dr. J. B. Firth, vice-chairman, presiding. Mr. Woodhouse said that in the Nottingham district itself, lime was utilised in leather manufacture, bleaching, soap-making, textiles, dyestuffs, glue, beet sugar, and agriculture. In addition, considerable quantities of limestone were used in blast furnace and other metallurgical processes. Whereas some years ago lime was prepared by a haphazard method of burning limestone in open heaps, with wood as the fuel, to-day it was burned under scientific control in gas-fired kilns, giving a product which was reliable for use in chemical industry. The lecture was illustrated with lantern slides, showing quarries and up-to-date lime burning kilns at Wirksworth.

Paper Making

THE NEW INSTITUTE FOR CELLULOSE TECHNIQUE and wood chemistry at the Stockholm Faculty of Technology has been officially inaugurated. The institute had gradually been put into use during the year, but the inauguration was postponed until the equipment was fairly complete, and in expectation of the autumn meeting of Svenska Cellulosafoereningen, the body that has rendered possible the foundation of the institute, thus realising hopes that had existed for many years. During the fifty years since its birth the Swedish pulp industry has grown into one of the most important industries of the country and now occupies a leading position in the world market, both technically and commercially.

Sugar Industry

THE QUESTION OF CO-OPERATION between sugar-producing countries to restrict production more severely is to be reopened, according to Mynheer Hartman, head of the Java delegation to the International Sugar Council, who in a statement made at The Hague, on January 19, expressed grave fears of a further fall in prices. He said it was clear that the limits of the Chadbourne scheme had been too wide for Java, whose production would not attain the quota granted in the first year of the agreement. Producers were therefore to examine proposals for a more drastic scheme of restriction. At present the Union of Java Sugar Producers controlled 86 per cent. of production, but if there were more defections from that body its demise at the end of the year was inevitable. The consequence would be a fall in prices calamitous to producers. Without the union the position of the Java sugar industry would be one of great danger.

Tanning

A STUDY HAS BEEN COMPLETED at the United States Bureau of Standards to determine whether the addition of grease to vegetable tanned leather retarded or accelerated its deterioration by sulphuric acid remaining from the bleaching process. Leather was tanned with chestnut and quebracho extracts and treated so that samples containing 0, 1, 2, 3 and 4 per cent. sulphuric acid were obtained. A further division of the samples was made and these were treated so as to contain 0, 10 and 20 per cent. by weight of a 50-50 mixture of cod oil and tallow. All the samples were tested for tensile strength and then stored at 70° F. and 65 per cent. relative humidity. Selected samples were again tested for tensile strength after 6, 12, 18 and 24 months. The change in strength of the samples during ageing was taken as a measure of their deterioration. The results showed no significant difference in the rate and amount of deterioration occurred whether the leather contained grease or not. The addition of grease, therefore, does not appear to influence the action of the sulphuric acid which may be present in leather before the grease is applied.

Lacquer Industry

THE USE OF GLYCERINE in the form of various conversion products and derivatives is discussed in detail in *The Manchester Guardian Commercial*, January 16. From the point of view of using glycerine derivatives in the manufacture of lacquers, Fairbourne's paper read before the Society of Chemical Industry is of particular interest. The I. G. Farbenindustrie, in Germany, had for some time been manufacturing monomethylglycol-ether as a solvent for acetyl cellulose and among the glycerine ethers investigated by Fairbourne the two isomeric dimethyl-ethers of b.p. 169° C. and 180° C. have been found to be among the best solvents for nitrocellulose. The same may be said of the diethyl-ether, b.p. 191° C. Most of the glycerine ethers, with the possible exception of the triethers are virtually odourless, colourless, and very stable under various conditions, such as atmospheric moisture content. This latter property is of particular value in the use of ditolylether, b.p. about 200° C. and lacquers made with this ether as softening agent may be diluted as desired with petroleum ether, toluol, or a mixture of both, according to the rate of drying required. Among the esters, another group of glycerine derivatives, triacetin is still being used to some extent as a softening agent in lacquers of the Zapon class.

From Week to Week

MR. H. E. PURKIS, of Malvern Link, formerly of Stourbridge and Kidderminster, chairman of Hepworth Ltd., chemical manufacturers, left £7,686 (net personalty £7,068).

PROPOSALS for the establishment in Manchester of a large food canning industry are to be considered at meetings to be held shortly, at which representatives of various industries interested in the scheme will be present.

THE LONDON CHAMBER OF COMMERCE announces that arrangements have been completed for the starting of a chemical factory by a Continental firm at Enfield. British labour will be employed.

DR. A. J. V. UNDERWOOD, after being for a time with the Anglo-Yugoslavian Wood Distillation Co., Ltd., and then with the Distillers Co., Ltd., has resumed his private practice at 14 Victoria Street, London, S.W.1, his former address.

THE APPLICATION OF X-RAYS to chemical problems was the subject of a lecture delivered to the Birmingham and Midland section of the Society of Chemical Industry by Mr. Gordon Cox on January 19. He discussed the application of X-rays in qualitative and quantitative analyses, and described various specialised applications in the study of some chemical problems. Dr. E. D. Mason presided.

UNEMPLOYMENT at December 21, according to returns published in the *Ministry of Labour Gazette* was as follows:—Chemicals, wholly unemployed 16,883 (temporary stoppages 1,208); explosives, wholly unemployed 1,970 (temporary stoppages 316); paint, varnish, red and white leads, wholly unemployed 2,083 (temporary stoppages 165); oil, glue, soap, ink and matches, wholly unemployed 8,653 (temporary stoppages 963).

INQUIRIES RECEIVED by the Hull Development Committee from foreign firms desirous of establishing works in this country include that of a Dutch firm, who ask for information as to a site for chemical works to employ 300 people. There has been a large increase in inquiries since the imposition of import duties, and the Development Committee has arranged for several interviews. Of the 70 inquiries that have been under consideration during the past two months, 40 were received direct. These inquiries have caused the Corporation to proceed at once with their application for Parliamentary powers to use water from the River Hull in order to be in a more favourable position to attract new industries to the city.

AT LEEDS UNIVERSITY last week Mr. C. R. Brotherton and Mr. Walter Denton handed to the chairman of the Finance Committee (Sir Ernest Bain) a cheque in payment of the legacy of £100,000 bequeathed for the general benefit of the University by the late Lord Brotherton, who, during his lifetime, also made gifts to the University amounting to £120,150. Chief among these were a sum of £20,000 for the endowment of the chair of bacteriology and £100,000 for the building of a new library. The erection of the library, to be known as the Brotherton Library, will be started shortly, the foundation stone having already been laid by Lord Brotherton in his lifetime.

THE CHEMICAL AND ALLIED TRADES section of the Manchester Chamber of Commerce held its annual meeting last week and adopted a report which mentions an increased value of exports of dyestuffs and an increased range of products in the fine chemical section. This Report adds that "The departure from the gold standard in September had a stimulating effect. In the latter portion of the year export trade certainly improved, and in certain branches of chemical manufacture whose raw materials are produced in the country it may well be that this increase can be maintained and even extended. The balance at present in our favour will, in certain cases, decrease as the cost of raw materials rises, and in this class it is unfortunate that we must place such important manufactures as sulphuric acid, the sulphur for which in one form or another is imported to the extent of about 75 per cent., and superphosphates, the raw material for which is essentially an import, whilst their manufacture involves the use of large quantities of sulphuric acid." Mr. Forrest Hewit was elected chairman of the Chemical and Allied Trades Section, and Mr. A. Heywood was re-elected hon. secretary.

THE PERFUMERY WORKS of Irving and Baldwin, Ponders End, was involved in a fire on Saturday, January 16.

BENN BROTHERS, LTD., proprietors of THE CHEMICAL AGE, have been elected to membership of the Federation of British Industries.

MERGER NEGOTIATIONS between the Sinclair Consolidated Oil Corporation and the Prairie Oil and Gas and the Prairie Pipeline Co. have now been completed.

LACK OF ORDERS is given as the reason for the closing down of the Freidrich Alfred Steel Foundry belonging to Krupps, at Essen. Some 4,250 workmen have been dismissed, but the company expects to be able to reopen the works some time next month.

DR. A. E. DUNSTAN, chief chemist of the Anglo-Persian Oil Co., gave an address last week, at Swansea, on "Liquid Fuels of To-day and To-morrow" to members of the West Wales section of the Society of Chemical Industry and Institute of Chemistry.

INTERIM DIVIDENDS of 6¼ per cent. on the ordinary shares and 1s. 3d. per share on the deferred shares have been declared by Benn Brothers, Ltd., publishers of THE CHEMICAL AGE and other journals. These rates are the same as those declared twelve months ago.

STRINGENT REGULATIONS drawn up under the Factory and Workshops Act in regard to workers handling asbestos are contained in a Home Office Order issued this week. The regulations stipulate extensive ventilation systems to disperse the dangerous asbestos dust, and the enclosing of all machinery which gives rise to the dust, and require that where such precautions cannot be made workers shall wear breathing apparatus, head covering and overalls. Young persons must not be employed where the material is touched by hand. These regulations come into force on March 1, but extension of time are granted where, to comply with the Order, alterations will be necessary.

MR. F. E. SMITH, chief engineer at the Billingham Research Station of Imperial Chemical Industries, Ltd., delivered an address on coal hydrogenation last week, at Cardiff, to members of the South Wales Coke Oven Owners' Association. It was neccessary, he said, that the oil produced from coal should be exactly equivalent to the natural product. They had succeeded in doing this by means of hydrogenation, in regard to the development of which they could place no limit, as something new was being constantly discovered. Dealing with the economic side, Mr. Smith said that petrol could be extracted from coal by hydrogenation at a cost of about 6d. or 7d. per gallon, but, owing to the tragically sudden fall in world prices, foreign petrol was imported into this country at about 2d. per gallon, plus 8d. duty. The price, however, was not likely to continue so low. In the present circumstances no private company could undertake the responsibility of erecting the necessary plant, as there was no security that succeeding Governments would continue to impose the duty.

Obituary

MR. WILLIAM MAXWELL, sales manager of the British Dyewood Co., London and Manchester, at his residence at Glasgow. Mr. Maxwell joined the British Dyewood Co. at its inception in 1898, having been previously with other dyewood firms.

MR. HOLLAND COMPTON, late head of the Department of Chemistry at Bedford College for Women, University of London, on December 22. Born at Preston, Lancashire, in 1866, Mr. Compton was educated at Stuttgart and later studied chemistry under Professor H. E. Armstrong at the City and Guilds Institute. In 1888 he was appointed lecturer and head of the Department of Chemistry at Bedford College in succession to Spencer U. Pickering. He held this post until 1919, when the department was divided and from that date until his retirement, on account of his health, in 1927 he was head of the Department of Organic Chemistry. He will be remembered by both organic and physical chemists on account of his work on acenaphthene, atomic energy and the specific heat of gases, molecular association and molecular magnitudes, osmotic pressure and electrolytic dissociation.

Patent Literature

Abstracts of Accepted Specifications

356,805. Dyes. A Carpmael, London. From I. G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. Application date, June 12, 1930.

2-Acetylamino-anthrahydroquinones are esterified and the products saponified and then treated with phosgene in the presence of an acid-binding agent. In an example an alkaline aqueous solution of the potassium salt of 2-aminoanthrahydroquinone-9-10-disulphuric ester is treated with phosgene until the amino group can no longer be detected. The product can be developed to give yellow dyeings. The disulphuric esters of 2-amino-3-brom- and 1-chlor-6-amino-anthrahydroquinones may be similarly treated, and the preparation of 1-chlor-6-aminoanthraquinone is described.

356,931. Optically-Active Phenyl-Propanol-Methylamines. I. G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. International Convention date, August 31, 1929. Addition to 354,975 (see The Chemical Age, Vol. xxv, p. 505).

Optically active 1-phenyl-2-methylamino-propanols-1 are obtained by resolution of the racemic base with *d*-tartaric acid, and are freed from the racemic base by precipitating one component of the base by adding an organic or inorganic acid to a solution of impure base or by adding an alkali or oxalate to a solution of a salt of the impure base. An example is given of the purification of a mixture of *l*-base and *dl*-base.

357,589. Destructive Hydrogenation of Tars, Etc. E. G. Brown and H. W. Strong, Norton Hall, The Green, Norton-on-Tees, Durham, and Imperial Chemical Industries, Ltd., Millbank, London. Application date, June 25, 1930.

Tars, phenols, hydrocarbon oils, etc., are hydrogenated in vapour phase in the presence of magnetic iron oxide or the product of its reduction in hydrogen, with or without a promoter such as tin or a metal or compound of groups 5 or 6. The catalyst may be obtained by melting iron in a current of oxygen and adding ammonium molybdate or chromium oxide, or by melting tin plate in oxygen, which yields a catalyst containing 0.1-1 per cent. of tin. An example is given of the treatment of a middle oil boiling at 200°-300° C.

357,749. Carbon Black. J. Y. Johnson, London. From I. G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. Application date, September 8, 1930.

Di-acetylene or a substitution product is incompletely burnt with oxygen, or oxides of carbon which may be preheated, and a dehydrogenating catalyst such as platinised asbestos may be employed. A special burner is employed in view of the explosive nature of the materials.

357,778. Active Carbon; Hydrogen. Metallges. Akt.-Ges., 45 Bocgenheimer Anlage, Frankfort-on-Main, Germany. International Convention date, October 4, 1929.

Active carbon and combustible gases containing hydrogen are obtained from cheap materials such as low temperature coke or brown coal, which are rich in ash forming constituents. Activation is effected at 500°-600° C. by means of steam containing up to 6 per cent. of free oxygen, with or without carbon dioxide. The temperature is maintained by the heat of the reaction. Examples are given in which waste gases containing 20-30 per cent. of hydrogen are obtained.

356,739. Ammonium Sulphate and Sulphur. H. Koppers Akt.-Ges., 29 Moltkestrasse, Essen, Germany. Assignees of F. Krupp Akt.-Ges., Essen, Germany. International Convention date, May 21, 1929.

Mixtures of ammonium bisulphite and sulphite or thiosulphate; or ammonium polythionates and sulphate or thiosulphate; or ammonium thiosulphate and sulphurous or sulphuric acid, with or without ammonium thiocyanate; are heated in vessels of chromium-nickel or chromium-nickel-iron alloys which are susceptible to attack by sulphuric acid, in the presence of 0.05-0.1 per cent. of the initial unconverted materials. The reaction may be effected in the presence of free sulphurous or sulphuric acid. The products are ammonium sulphate and sulphur.

356,759. Fertilisers; Ammonium Salts. Ruhrchemie Akt.-Ges., Holten Oberhausen, Germany. International Convention date, March 2, 1929.

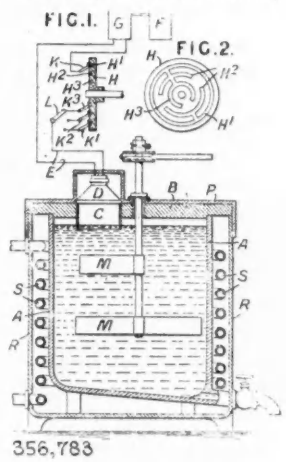
Ammonium nitrate is treated with liquid or gaseous ammonia to form a solid or liquid solution of the salt, and the ammonia is neutralised with sulphuric or phosphoric acid, acid anhydrides, or acid salts, such as potassium bisulphate. The water content may be so controlled that a dry product is obtained by evaporation due to the heat of neutralisation. The ratio of nitrate to ammoniacal nitrogen may be varied by varying the temperature and pressure employed. Two examples are given of the production of ammonium sulphate-nitrate.

356,767. Cleansing Compositions. L. T. Howells, and Electric Smelting and Aluminum Co., 7016 Euclid Avenue, Cleveland, Ohio, U.S.A. Application date, June 4, 1930.

Soluble hypochlorites, such as sodium hypochlorite are activated in solution or in the dry stage by neutralising the free alkali without spontaneous decomposition by adding a soluble fluosilicate with or without a soluble fluoride. The product consists of colloidal silicon hydroxide and a hypochlorite.

356,783. Sterilising Perishable Organic Substances. V.C. From, 7 Rue de Trevize, Paris, and C. D. Rowley, 15 St. James's Place, London. Application date, May 10, 1930.

Liquid or solid perishable organic materials are preserved or sterilised by treatment with intense sound waves which may be of infra or supersonic frequencies, preferably applied intermittently. It is found that bacteria may thus be rendered innocuous or destroyed. The necessary intensity varies



in different cases. The temperature is below that of pasteurisation, and may be above or below that favourable to bacteria propagation. Thus, milk may be treated at 120°-135° F., and eggs down to 14° F. The treatment may be effected in a chamber which is in resonance with the sound waves, or tuned resonating devices may be provided to cause intense sound waves to pass through the substance treated.

A liquid may be treated in a chamber A, having a cover B, in which is mounted a sound generator D, which may be energised from a thermionic valve oscillator F and amplifier G. Intermittent sound is obtained by means of a rotating disc H having contacts H^1, H^2, H^3. The frequency of the sound waves may be varied. A rotary stirrer M may be provided, and a temperature regulating jacket R, with steam coil S.

356,838. Combustible Gases. H. Kemmer, 4 Zahringerstrasse, Wilmersdorf, Berlin. International Convention date, June 22, 1929.

Coal gas, producer gas, or water gas is treated by a two-stage contact process. In the first stage, most of the carbon monoxide is converted by steam into carbon dioxide and hydrogen in the presence of an oxidising agent such as chromiferous iron and substances capable of liberating hydro-

gen and oxygen from the reacting substances, preferably active charcoal or lignite coke. In the second stage, the remaining carbon monoxide is converted into methane and water vapour by hydrogen in the presence of similar catalysts together with a catalyst such as nickel at a temperature of 180°-250° C.

357,026. PHOSPHORUS, PHOSPHORIC ANHYDRIDE, AND PHOSPHORIC ACID. Metallges. Akt.-Ges., 45 Bockenheimer Anlage, Frankfort-on-Main, Germany. International Convention date, January 6, 1930.

Finely-divided red phosphorus is burnt in an apparatus such as is used for the combustion of powdered fuel, with air which may be enriched with oxygen. The phosphorus may be obtained by the reduction of phosphates by adding iodine, bromine, or nitrogen oxide to the furnace gases to accelerate the conversion into the red variety, or by superheating the gases under excess pressure and then cooling and expanding. The red phosphorus may be injected into the combustion chamber through nozzles together with air or may be caused to impinge on a rapidly rotating disc in the combustion chamber. The phosphoric anhydride may be converted into phosphoric acid.

Specifications Accepted with Date of Application

363,986 and 364,040. Acidylated aromatic amines, Manufacture of. H. Dreyfus. August 15, 1930.

364,000. Hydroxylated ethers of tertiary hydroxy-alkyl-amines, Manufacture of. J. Y. Johnson. (*I. G. Farbenindustrie Akt.-Ges.*). July 25, 1930.

364,041. Anhydrous alkali metal salts of 5. 5-di-aliphatic-substituted barbituric acids, and Processes of producing them. E. Lilly & Co. June 22, 1929.

364,042. Benzanthrone, Methods of producing. W. W. Triggs. (*E. I. Du Pont de Nemours & Co.*) June 24, 1930.

364,043. Catalytic treatment of hydrocarbons at high temperatures. British & Dominions Feralloy, Ltd., and J. W. Bampfylde. July 17, 1930.

364,048. Sulphide blacks, Manufacture of. Imperial Chemical Industries, Ltd. (*E. I. Du Pont de Nemours & Co.*). September 24, 1930.

364,049. Purifying zinc chloride, Process of. A. E. White. (*American Smelting & Refining Co.*). September 24, 1930.

364,023. Aliphatic aldehydes, Manufacture of. British Celanese, Ltd., D. Finlayson, and J. H. G. Plant. September 25, 1930.

364,033. Di-calcium or di-magnesium phosphate, and mixed fertilizers containing the same, Production of. Kali-Forschungs-Anstalt Ges. November 1, 1929.

364,050. Vat dyestuffs, Manufacture of. I. G. Farbenindustrie Akt.-Ges. September 26, 1930. Addition to 11940/30 and 14359/30.

364,060. Electrolytic production of thiocyanide derivatives. Rohm & Haas Co. October 3, 1929.

364,061. Organic sulphur compounds. J. Mrochem and P. Mochalle. September 30, 1929.

364,087. Vat dyestuffs, Manufacture of. J. Y. Johnson. (*I. G. Farbenindustrie Akt.-Ges.*). June 28, 1930.

364,089. Polymerization products, Manufacture of. J. Y. Johnson. (*I. G. Farbenindustrie Akt.-Ges.*). August 21, 1930.

364,103. Sulphur dioxide, Recovery of—from products obtained in the treatment of mineral oils and tars or their distillates. Bolgar Oil Processes, Ltd., P. A. Mackay, and W. R. Ormandy. July 10, 1930.

364,106. Hydrocarbons not saturated with hydrogen, and hydrogen from gas mixtures containing hydrocarbons, Manufacture of. J. Y. Johnson. (*I. G. Farbenindustrie Akt.-Ges.*). August 20, 1930.

364,111. Absolute alcohol and commercially pure powdered hydrated lime, Preparation of. R. W. James. (*Merck & Co. Inc.*). September 22, 1930.

364,112. Composite calcium sulphate titanium oxide pigments, Manufacture of. Titanium Pigment Co., Inc. September 24, 1929.

364,116. 1:4:5:8-naphthalene-tetra-carboxylic acid, Manufacture of. I. G. Farbenindustrie Akt.-Ges. September 26, 1929.

364,134. Higher alcohols from ethyl alcohol, Manufacture of. O. Fuchs and W. Querfurth. July 26, 1930.

364,141. Halogenation of anthraquinone and its derivatives. Imperial Chemical Industries, Ltd., W. W. Tatum, and R. F. Thomson. September 2, 1930.

364,144. Conversion of methane into liquid hydrocarbons. J. Y. Johnson. (*I. G. Farbenindustrie Akt.-Ges.*). September 22, 1930.

364,147. Azo-dyestuffs containing chromium, Manufacture of. Soc. of Chemical Industry in Basle. September 26, 1929.

364,187. Nitroarylamino derivatives of leuco sulphuric acid esters of anthraquinonoid and indigoid compounds, Manufacture of. A. Carpmael. (*I. G. Farbenindustrie Akt.-Ges.*). October 7, 1930.

364,201. Ammonium salts, Production of. Gutehoffnungshutte Oberhausen Akt.-Ges. October 12, 1929.

364,215. Carrying out catalytic gas reactions, Method of and apparatus for. E. H. Sale and Imperial Chemical Industries, Ltd. October 18, 1930.

364,225. Metallic cyanamides, Manufacture of. H. Wittek. October 24, 1930.

364,243. Oxidizible organic compounds, Process of preserving. Goodyear Tire & Rubber Co. January 13, 1930.

364,255. Acetaldehyde and acetic acid, Manufacture of. J. Y. Johnson. (*I. G. Farbenindustrie Akt.-Ges.*). November 14, 1930.

364,323. Hydroxy-alkyl-polyvinyl compounds, Manufacture of. I. G. Farben-Akt.-Ges. December 27, 1929.

364,351. Sulphur from roaster gases, Recovery of. R. F. Bacon. January 12, 1931.

364,361. Chromates and dichromates, Process for the manufacture of. Bozel Maletra, Soc. Industrielle de Produits Chimiques. May 9, 1930.

364,394. Organic derivatives of bromine, Preparation of. S. Hermann and Pharmaceutische Werke Norgine Akt.-Ges. May 10, 1930.

364,401. Destructive hydrogenation of hydrocarbon oils. Standard-I. G. Co. March 13, 1930.

364,418. Thermal decomposition of hydrocarbons. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. March 10, 1930.

364,419. Hydrogen from hydrocarbon gases, Production of. Standard-I. G. Co. March 7, 1930.

Applications for Patents

[In the case of applications for patents under the International Convention, the priority date (that is, the original application date abroad which the applicant desires shall be accorded to the patent) is given in brackets, with the name of the country of origin. Specifications of such applications are open to inspection at the Patent Office on the anniversary of the date given in brackets, whether or not they have been accepted.]

Anderson, I. B., Imperial Chemical Industries, Ltd., and Thomson, R. F. Manufacture &c. of dyestuffs. 1190, 1191. January 14.

Bradley, W., Imperial Chemical Industries, Ltd., Loveluck, R. J., and Thomson, R. F. Production of anthraquinone derivatives. 1302. January 15.

Broadbent, T., & Sons, Ltd. Hydro-extractors. 738. January 11.

Bunbury, H. M., Hailwood, A. J., and Imperial Chemical Industries, Ltd. Stabilised acid latex preparations. 1189. January 14.

Cederberg, I. W. Catalytic combustion of ammonia with oxygen &c. 887. January 12. (Germany, January 12, '31.)

Coles, S. O. Cowper-. Sherardizing. 837. January 12.

Dupont, G. F. N. and Physical Chemistry Research Co. Distillation of combustible solids and liquids. 814. January 11.

Geigy Akt.-Ges., J. R. Manufacture of black trisazo dyestuffs. 1269. January 15. (Germany, January 16, '31.)

Groves, W. W. Manufacture of acid dyestuffs. 1150. January 14. (Germany, January 14, '31.)

I. G. Farbenindustrie Akt.-Ges. Manufacture of amino-substituted organic arsenic compounds. 812. January 11. (Germany, January 10, '31.)

—— Sensitizing silver-halide emulsions. 813. January 11. (Germany, January 10, '31.)

—— Manufacture of dihydroxy naphthalene dicarboxylic acid. 957. January 12. (Germany, January 12, '31.)

—— Sensitizing silver-halide emulsions. 1038. January 13. (Germany, January 13, '31.)

—— Manufacture of stable acridine salt solutions. 1297. January 15. (Germany, January 15, '31.)

Imperial Chemical Industries, Ltd., and Kamm, E. D. Hydrogenation of phenols &c. 1077. January 13.

—— Refrigeration. 1357, 1358. January 16.

Johnson, J. Y. (*I. G. Farbenindustrie Akt.-Ges.*). Apparatus for manufacture of metal carbonyls. 806. January 11.

—— Manufacture and production of candles. 1027. January 13.

—— Manufacture of assistants for textile, &c., industries. 1260. January 15.

Koppers Co. of Delaware. Dephenolization. 1058. January 13. (United States, January 13, '31.)

Llewellyn, W. B., and P. Spence & Sons, Ltd. Preparation of titanium and iron compounds. 848. January 12.

Naamlooze Vennootschap de Bataafsche Petroleum Maatschapij. Production of hydrated olefines. 1049. January 13. (United States, January 14, '31.)

Pranke, E. J. Production of cyanides. 1085. January 13.

Rosenhain, W. Treatment of acid and rust resisting steels. 1050. January 13.

Schering-Kahlbaum Akt.-Ges. Manufacture of 3.5-diiodo-4-pyridine. 956. January 12. (Germany, February 11, '31.)

Thermal Syndicate, Ltd. Filtering. 1211. January 15.

Titanium Pigment Co., Inc. Production of soaps. 1300. January 15. (United States, January 16, '31.)

Points from Manufacturers' Literature

The Editor welcomes copies of new brochures and leaflets describing plant, equipment and products of interest to chemical manufacturers and the chemical-using trades.

NOTES ON THE SELECTION OF SINGLE PHASE MOTORS and starters are given in a special leaflet (No. 7022/0) issued by Metropolitan-Vickers Electrical Co., Ltd., of Trafford Park, Manchester. The squirrel-cage induction motors described are claimed to be the cheapest form of single-phase motor available but owing to an inherently low starting torque their use is limited to drives where light starting is required and to the smaller horse-powers. In order to start a single-phase induction motor, some form of phase-splitting device must be employed during the starting period, and for squirrel-cage motors the torque so obtained is only sufficient to run the motor up to speed when lightly loaded, unless the starting current is allowed to rise to a value that the supply authorities are unlikely to permit. It is, therefore, usual to apply the load after the motor has reached full speed, by means of a fast and loose pulley drive, or by a clutch. Phase-splitting is effected partly by the starting winding in the motor and partly by a resistance starter. By this means the starting torque per ampere is kept to a low value, since the starting and running windings are in series during starting. It is also easy to increase the resistance of the starter in cases where the starting current has to be limited to meet customers' or supply authorities' requirements.

* * *

IN THEIR NEW COMPREHENSIVE CATALOGUE of "Wask" British malleable pipe fittings (No. 171), Walter Slingsby and Co., Ltd., Woodhouse Road, Keighley, point out the various features of pipe fittings made in accordance with the requirements of the British Standard Specifications, illustrating the advantages secured by the adoption of the taper screw thread which is the only thread capable of giving a complete metal to metal joint throughout the length of the threads engaged. Other advantages which accrue from the exclusive adoption of British standard fittings are uniformity of dimensions (ensuring interchangeability between the fittings whether made by one or several manufacturers and a uniform appearance), the ability to obtain interchangeable fittings from stock, convenience in ordering and freedom from error due to a standard nomenclature and method of reading the outlets, and the assurance that each type of fitting has been designed to fulfil in the most satisfactory manner the purpose for which it is intended.

* * *

THE ECONOMY OF HEATING WATER by the direct injection of steam is dealt with in a new leaflet of The Sihi Self Priming Pump Co., Standish Road, Fallowfield, Manchester. The principle adopted in the Linfield heater-circulator is that of the steam ejector, by which a small proportion of steam is introduced by specially shaped cones or nozzles to a very large proportion of water. This ensures instant condensation of the steam without noise or vibration. The pressure of the steam is instantly destroyed and does not enter the heating circuit, but the ejector or pumping action set up causes a vigorous circulation of the heated water throughout the pipe system and radiating surfaces to which the heater-circulator is attached. The effect is to provide an accelerated low pressure hot water system for either heating or hot water supply. A Linfield heater-circulator supplied with steam at 50 lb. gauge pressure will circulate against a frictional resistance up to 35 ft. head of water.

* * *

TAPE CHART RECORDERS for vacuum draft; low and high pressure; differential draft and pressure; differential temperatures; humidity; steam, liquid and gas volumes, and liquid levels are described in a new leaflet (No. 164) of the Drayton Regulator and Instrument Co., Ltd., West Drayton, Middlesex. These instruments are becoming increasingly popular as they permit the recording of any number of values up to six on one and the same chart. Any combination of records desired can also be assembled in the same case, to facilitate comparison of simultaneous processes in the most convenient manner, at the same time permitting economy of space and attention. The record is visible from the moment the instrument operates and for a considerable time prior to this, depending on the rate of feed. For instance, with the normal paper feed rate of $\frac{3}{4}$ inch per hour, the record is visible for 12 hours; such a chart needs to be renewed once every two months. The pen draws its ink supply by capillary action from a large ink well and daily filling is thereby avoided.

* * *

THE INSTALLATION OF BOILERS receives editorial attention in the January issue of *Concord*, which is issued by The Liverpool Borax Co., Ltd., Maxwell House, St. Paul's Square, Liverpool. The contents of this trade organ are written in non-technical language, and are varied in character. In this issue, for instance, there are notes on boiler explosions, boiler inspection, fuel and related matters. In regard to economiser explosions it is stated that no satisfactory explanation has been found of the cause of many explosions of flue gas feed water heaters. Explosive mixtures of gases have sometimes been blamed, and other causes suggested include corrosion, water hammer and defective material or design. If the boiler feed be interrupted for some time, steam will be formed in the economiser and, if it can force water back through the feed pump, the steam will collect in the economiser and become superheated. Apart from internal stresses arising from the construction and erection of the economiser, the latter will then be subjected to serious thermal stresses. These may be aggravated by gradual growth of the cast-iron. If breakage occurs, the water remaining in the economiser will produce a destructive explosion. In order to eliminate this danger a non-return valve should be provided between the economiser and feed pump. The effect of this is to cause the economiser safety valve to blow off before much steam can collect in the tubes. An automatic air release valve is also recommended: this also evacuates steam and may be provided with an automatic alarm.

* * *

FINE CHEMICAL PRODUCTS to the number of over 4000 are included in the January issue of the catalogue issued by The British Drug Houses, Ltd., Graham Street, City Road, London, N.1. By means of the control which is exercised through its staff of chemists, this firm seeks persistently not only to maintain but to enhance the high standard of purity and the reputation for reliability for which the B.D.H. pure chemicals for scientific purposes are now well known. Among the new manufactures are abietic acid, acridine hydrochloride, adenine cytosine dinucleotide, adenylic acid, aluminium potassium fluoride, ammonium pyrophosphate, amyl *iso*-butyrate, *n*-amyl iodide, aurine-tricarboxylic acid (ammonium salt), Barium diphenylamine sulphonate (oxidation-reduction indicator), benzyl oxalate, *o*-bromo-anisole, *p*-bromo-anisole, *o*-bromo-benzoyl chloride, bromo 2 : 4 dinitrobenzene butyl alcohol (tertiary) *n*-butyl-*n*-butyrate, *n*-butyl-*iso*-butyrate, *n*-butyl tartrate, cacotheline, calciferol (crystalline vitamin D), calciferyl dinitrobenzoate, calcium silicofluoride, "carbosorb" (for absorption of CO_2), β-chloro-ethane-sulphonchloride, chromium ammonium oxalate, cobalt ammonium sulphate (nickel and iron free) cytidylic acid desoxycholic acid, dibromo-fluorescein, $\beta\beta^1$ dichloro-diethyl sulphate, dichloro-dimethyl sulphate, *op*-dihydroxy-benzene-azo-*p*-nitrobenzene, 3 : 5 dinitro-benzoyl chloride, erythrolitmin (sodium salt), ethyl *iso*-butyrate, ethyl propyl-malonate, fluorescein thallium, furfural specially purified, glucinum carbonate, glyoxaline, guanylic acid, hexabromo-stearic acid, *r*-hydroxy-2-hydrindamine hydrochloride, magnesium acetate, sodium free, methyl-*m*-nitrobenzoate, *a*-naphthyl isocyanate, nickel tartrate, *m*-nitro-anisole, *o*-nitrobenzaldehyde-phenylhydrazone, *o*-nitro-diphenyl, *p*-nitro-diphenyl, nitroso-*N*-ethyl-urethane, phenyl isothiocyanate, potassium selenocyanate, propyl *p*-hydroxy-benzoate, *n*-propyl sulphate, pyridine hydrochloride, rhodizonic acid (sodium salt), selenic acid, selenium precipitated (red), sodium desoxycholate, sodium hydrosulphide, sodium stannichloride, sodium tellurite, stearic acid, specially pure, tetra-bromo-*o*-cresol, tetra-bromo-tetra-chloro-fluorescein, thio-indoxyl, thymoxyacetic acid, tin citrate (stannous) *p*-toluidine sulphate, tribromo-fluorescein, trichloracetyl chloride, triphenyl-guanidine-hydrochloride, uranium zinc acetate (uranyl) vinyl acetate technical and *p*-xenylamine. Chemicals characterised by the letters A.R. (analytical reagent) are guaranteed to conform to the standards of purity given in the *B.D.H. Book of A.R. Standards.*

Weekly Prices of British Chemical Products

The prices and comments given below respecting British chemical products are based on direct information supplied by the British manufacturers concerned. Unless otherwise qualified, the figures quoted apply to fair quantities, net and naked at makers' works.

General Heavy Chemicals

ACID, ACETIC, 40% TECH.—£19 15s. per ton d/d address U.K. in casks.

ACID CHROMIC.—11d. per lb., less 2½% d/d U.K.

ACID HYDROCHLORIC.—Spot, 3s. 9d. to 6s. carboy d/d, according to purity, strength and locality.

ACID NITRIC, 80° Tw.—Spot, £20 to £25 per ton makers' works, according to district and quality.

ACID SULPHURIC.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations; 140° Tw., Crude acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.

AMMONIA (ANHYDROUS).—Spot, 10d. per lb., d/d in cylinders.

AMMONIUM BICHROMATE.—8d. per lb., d/d U.K.

BISULPHITE OF LIME.—£7 10s. per ton, f.o.r. London, packages free.

BLEACHING POWDER, 35/37%.—Spot, £8 15s. per ton d/d station in casks, special terms for contracts.

BORAX, COMMERCIAL.—Granulated, £15 10s. per ton; powder, £17 per ton. (Packed in 1 cwt. bags, carriage paid any station in Great Britain. Prices quoted are for one ton lots and upwards.)

CALCIUM CHLORIDE (SOLID), 70/75%.—Spot, £5 5s. to £5 15s. per ton d/d station in drums.

CHROMIUM OXIDE.—10d. to 10½d. per lb. according to quantity d/d U.K.

CHROMETAN.—Crystals, 3¾d. per lb. Liquor, £19 10s. per ton d/d U.K.

METHYLATED SPIRIT 61 O.P.—Industrial, 1s. 8d. to 2s. 3d. per gall.; pyridinised industrial, 1s. 10d. to 2s. 5d. per gall.; mineralised, 2s. 9d. to 3s. 3d. per gall. 64 O.P., 1d. extra in all cases. Prices according to quantity.

NICKEL SULPHATE.—£38 per ton d/d.

NICKEL AMMONIA SULPHATE.—£38 per ton d/d.

POTASH CAUSTIC.—£30 to £33 per ton.

POTASSIUM BICHROMATE CRYSTALS AND GRANULAR.—5d. per lb. net d/d U.K., discount according to quantity; ground 5¾d. per lb.

POTASSIUM CHLORATE.—3¾d. per lb. ex-wharf, London, in cwt. kegs.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

SALAMMONIAC.—First lump, spot, £42 17s. 6d. per ton d/d address in barrels. Chloride of ammonia, £37 to £45 per ton, carr. paid.

SALT CAKE, UNGROUND.—Spot, £3 15s. per ton d/d station in bulk.

SODA ASH, 58%.—Spot, £6 per ton, f.o.r. in bags, special terms for contracts.

SODA CAUSTIC, SOLID, 76/77° E.—Spot, £14 10s. per ton, d/d station.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton, d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE 97/98%.—£21 per ton.

SODIUM BICARBONATE, REFINED.—Spot, £10 10s. per ton d/d station in bags.

SODIUM BICHROMATE CRYSTALS, CAKE AND POWDER.—4d. per lb. net d/d U.K., discount according to quantity. Anhydrous 5d. per lb.

SODIUM BISULPHITE POWDER, 60/62%.—£16 10s. per ton delivered 1-cwt. iron drums for home trade.

SODIUM CHLORATE.—2¾d. per lb.

SODIUM CHROMATE.—3¾d. per lb. d/d U.K.

SODIUM NITRITE.—Spot, £19 per ton, d/d station in drums.

SODIUM PHOSPHATE.—£15 per ton, f.o.r. London, casks free.

SODIUM SILICATE, 140° Tw.—Spot, £8 5s. per ton, d/d station returnable drums.

SODIUM SULPHATE (GLAUBER SALTS).—Spot, £4 2s. 6d. per ton, d/d.

SODIUM SULPHIDE SOLID, 60/62%.—Spot, £10 15s. per ton, d/d in drums. Crystals—Spot, £7 15s. per ton, d/d in casks.

SODIUM SULPHITE, PEA CRYSTALS.—Spot, £13 10s. per ton; d/d station in kegs. Commercial—Spot, £9 10s. per ton, d/d station in bags.

Coal Tar Products

ACID CARBOLIC CRYSTALS.—5½d. to 6¾d. per lb. Crude 60's 1s. 4d. to 1s. 5d. per gall.

ACID CRESYLIC 99/100.—1s. 8d. to 1s. 9d. per gall. B.P., 2s. 6d. to 3s. per gall. Refined, 2s. to 2s. 2d. per gall. Pale, 98%, 1s. 7d. to 1s. 8d. Dark, 1s. 4d. to 1s. 4½d.

BENZOLE.—Prices at works: Crude, 7d. to 7½d. per gall.; Standard Motor, 1s. 2d. to 1s. 3d. per gall. 90%.—1s. 3d. to 1s. 4d. per gall. Pure, 1s. 6d. to 1s. 7d. per gall.

TOLUOLE.—90%, 2s. 4d. per gall. Pure, 2s. 6d. per gall.

XYLOL.—2s. per gall. Pure, 2s. 3d. per gall.

CREOSOTE.—Standard specification, for export, 4¾d. to 5d. net per gall. f.o.b.; for Home, 3¾d. per gall. d/d.

NAPHTHA.—Solvent, 90/160, 1s. 3d. per gall. Solvent, 95/160, 1s. 5d. to 1s. 6d. per gall. Solvent, 90/190, 11d. to 1s. 2d. per gall.

NAPHTHALENE.—Purified Crystals, £11 10s. per ton, in bags.

PITCH.—Medium soft, 70s. per ton, in bulk at makers' works.

PYRIDINE.—90/140, 3s. 9d. to 4s. per gall. 90/160, 4s. to 4s. 6d. per gall. 90/180, 2s. to 2s. 6d. per gall.

Intermediates and Dyes

In the following list of Intermediates delivered prices include packages except where otherwise stated:—

ACID, BENZOIC, B.P. (ex Toluol).—1s. 9½d. per lb.

ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.

ACID H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

ACID NAPHTHIONIC.—1s. 2d. per lb. 100% d/d buyer's works.

ACID NEVILLE AND WINTHER.—Spot, 3s. per lb. 100% d/d buyer's works.

ACID SULPHANILIC.—Spot, 8¾d. per lb. 100% d/d buyer's works.

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra, d/d buyer's works.

BENZIDINE BASE.—Spot, 2s. 5d. per lb. 100% d/d buyer's works.

o-CRESOL 30/31° C.—£2 6s. 5d. per cwt., in 1-ton lots.

m-CRESOL 98/100%.—2s. 9d. per lb., in ton lots.

p-CRESOL 34.5° C.—1s. 9d. per lb., in ton lots.

DICHLORANILINE.—2s. 2d. per lb.

DIMETHYLANILINE.—Spot, 1s. 6d. per lb., packages extra, d/d buyer's works.

DINITROBENZENE.—8½d. per lb.

DINITROTOLUENE.—48/50° C., 8d. per lb.; 66/68° C., 8¾d. per lb.

DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.

α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.

β-NAPHTHOL.—Spot, £75 per ton in 1 ton lots, d/d buyer's works.

α-NAPHTHYLAMINE.—Spot, 11½d. per lb., d/d buyer's works.

β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb. d/d buyer's works.

o-NITRANILINE.—5s. 10d. per lb.

m-NITRANILINE.—Spot, 2s. 6d. per lb. d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 8d. per lb. d/d buyer's works.

NITROBENZENE.—Spot, 6½d. per lb.; 5-cwt. lots, drums extra, d/d buyers' works.

NITRONAPHTHALENE.—8½d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb. 100% d/d buyer's works.

o-TOLUIDINE.—Spot, 9½d. per lb., drums extra, d/d buyer's works.

p-TOLUIDINE.—Spot, 1s. 9d. per lb., d/d buyer's works.

m-XYLIDINE ACETATE.—3s. 6d. per lb., 100%.

Wood Distillation Products

ACETATE OF LIME.—Brown, £7 10s. per ton. Grey, £12 per ton. Liquor, 8d. to 9d. per gall.

ACETIC ACID, TECHNICAL, 40%.—£16 15s. to £17 15s. per ton.

ACETONE.—£63 to £65 per ton.

AMYL ACETATE, TECHNICAL.—90s. to 98s. per cwt.

CHARCOAL.—£6 10s. to £10 10s. per ton, according to grade and locality.

IRON LIQUOR.—24°/30° Tw., 10d. to 1s. 2d. per gall.

METHYL ACETONE, 40/50%.—£52 per ton.

RED LIQUOR.—16° Tw., 8½d. to 10d. per gall.

WOOD CREOSOTE.—1s. to 2s. 6d. per gall., unrefined.

WOOD NAPHTHA, MISCIBLE.—3s. to 4s. per gall. Solvent, 3s. 9d. to 4s. 9d. per gall.

WOOD TAR.—£2 10s. to £6 per ton.

BROWN SUGAR OF LEAD.—£32 per ton.

Pharmaceutical and Photographic Chemicals

The following changes are reported in the markets for Pharmaceutical and Photographic Chemicals:—

ACID, ACETIC.—Pure 80%, £38 5s. per ton.

ACETANILIDE.—1s. 6d. per lb.

BISMUTH, CARBONATE.—6s. 6d. per lb.

BISMUTH, CITRATE.—8s. 10d. per lb.

BISMUTH, NITRATE (CRYST).—4s. 4d. per lb.

BISMUTH, OXIDE.—10s. per lb.

BISMUTH, SALICYLATE.—7s. 3d. per lb.

BISMUTH, SUBCHLORIDE.—9s. 9d. per lb.

BISMUTH, SUBGALLATE.—6s. 11d. per lb.

BISMUTH, SUBNITRATE.—5s. 7d. per lb.

LIQUOR BISMUTHI, P.B.—In W.Qt. 1s. 1¾d. per lb.; in 6 W.Qts., 11d. per lb.; in 12 W.Qts., 9¾d. per lb.; in 36 W.Qts., 9d. per lb.

CHLOROFORM.—2s. 3d. to 2s. 6½d. per lb.

POTASSIUM IODIDE, B.P.—23s. 2d. to 26s. 2d. per lb.

SODIUM POTASSIUM TARTRATE (ROCHELLE SALT).—80s. per cwt.

Rubber Chemicals

There are no changes to report in the market prices of rubber chemicals which were quoted last week (p. 58).

London Chemical Market

The following notes on the London Chemical Market are specially supplied to THE CHEMICAL AGE *by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., and may be accepted as representing these firms' independent and impartial opinions.*

London, January 20, 1932.

INQUIRY for the various chemicals during the current week has been maintained, with a tendency for prices to move upwards.

General Chemicals

ACETONE.—In good demand at £65 to £68 per ton.

ACID, ACETIC.—Is in regular daily demand and firm at £37 5s. to £39 5s. for Technical 80% and £38 5s. to £40 5s. per ton for Pure 80%.

ACID, CITRIC.—The demand is improving with price at about 1s. 1½d. per lb., less 5%.

ACID, FORMIC.—Is firm at £50 10s. to £52 per ton.

ACID, OXALIC.—Is firm at £50 per ton in casks and £51 10s. per ton in kegs.

ACID, TARTARIC.—Is in good demand and very firm at 1s. 1½d. to 1s. 2d. less 5%.

ALUMINA SULPHATE.—£8 15s. to £9 10s. per ton.

ARSENIC.—The inquiry is maintained with the market unchanged. Imported material quoted at about £24 per ton c.i.f. main U.K. ports; Cornish material only available for forward delivery at about £28 per ton.

BARIUM CHLORIDE.—In steady demand at about £11 10s.

CREAM OF TARTAR.—Is very firm at 103s. 6d. per cwt. to 105s. per cwt.

FORMALDEHYDE.—In good steady request at about £30 per ton.

LEAD ACETATE.—Is firm at £43/44 per ton.

LITHOPONE.—Continues firm at about £30 per ton.

POTASH BICHROMATE.—Is firm at 5d. per lb., and in good demand, with discounts for contracts.

POTASH CHLORATE.—In good request at £32/34 per ton.

PERMANGANATE OF POTASH.—Needle Crystals B.P. in daily demand at 8½d. per lb.

POTASSIUM PRUSSIATE.—Firm and in good demand at 8½d. per lb.

SODIUM ACETATE.—Is a little easier at about £21 per ton.

SODIUM BICHROMATE.—In daily demand at 4d. per lb., with discounts for contracts.

SODIUM CHLORATE.—In good steady request at about £30 per ton.

SODIUM HYPOSULPHITE.—Continues firm at the recently advanced prices.

SODIUM NITRITE.—Firm at about £20/21 per ton.

SODIUM PRUSSIATE.—Firm at 5d. to 5¾d. per lb.

SODIUM SULPHIDE.—Continues in fair demand at British makers' prices.

ZINC SULPHATE.—Steady at £20 per ton.

Coal Tar Products

THE coal tar products market remains inactive; prices, however, are still firm, with a tendency to rise.

MOTOR BENZOL.—Quoted at about 1s. 4½d. to 1s. 5½d. per gallon f.o.r.

SOLVENT NAPHTHA.—Is unchanged, at about 1s. 1½d. to 1s. 2d. per gallon f.o.r.

HEAVY NAPHTHA.—Remains at about 11d. to 1s. 0½d. per gallon f.o.r.

CREOSOTE OIL.—Is obtainable at about 3d. to 3½d. per gallon f.o.r. in the North, and at about 4d. to 4½d. per gallon in London.

CRESYLIC ACID.—Is unchanged, at about 1s. 6d. per gallon f.o.r. for the 98/100% quality, and at about 1s. 4d. per gallon for the Dark quality 95/97%.

NAPHTHALENES.—Remain at £3 to £3 10s. per ton for the firelighter quality, at £4 to £4 10s. per ton for the 74/76 quality, and at about £5 10s. to £6 per ton for the 76/78 quality.

PITCH.—Is unchanged, at about 67s. 6d. per ton, f.o.b. East Coast Port.

Latest Oil Prices

LONDON, January 20.—LINSEED OIL was steady. Spot, ex mill, £16; January, £13 10s.; February-April, £14 10s.; May-August £15 12s. 6d.; September-December, £16 15s. per ton, naked. RAPE OIL was quiet. Crude, extracted, £29 10s.; technical, refined, £31 10s. per ton, naked, ex wharf. COTTON OIL was quiet. Egyptian, crude, £18; refined common edible, £22; and deodorised, £24 per ton, naked, ex mill. TURPENTINE was quiet. American, spot, 52s.; February-April, 52s. 9d. per cwt.

HULL.—LINSEED OIL.—Spot and January closed at £14 5s. per ton; February-April at £14 12s. 6d.; May-August at £15 10s.; and September-December at £16 15s., naked. COTTON OIL.—Egyptian, crude, spot, £17 15s.; edible, refined, spot, £20; technical, spot, £20; deodorised, £22 per ton, naked. PALM KERNEL OIL.—Crude, f.m.q., spot, £24 per ton, naked. GROUNDNUT OIL.—Crushed extracted, spot, £29 10s.; deodorised, £33 10s. per ton. SOYA OIL.—Crushed/extracted, spot, £20; deodorised, £23 10s. per ton. RAPE OIL.—Crushed/extracted, spot, £28 10s.; refined, £30 10s. per ton. COD OIL, 16s. 3d. per cwt. CASTOR OIL.—Pharmacy, spot, 45s. 6d.; first, 40s. 6d.; second, 38s. 6d. per cwt. TURPENTINE.—American, spot, 54s. 6d. per cwt.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—Export.—During the past week the market has been quiet. No large business has been reported, and the price remains unchanged at £5 5s. per ton f.o.b. U.K. port in single bags. *Home.*—The prices announced in our last issue remain unchanged. A few small purchases have been reported for delivery in the Spring, but during this season of the year there is little interest in this product.

IMPORTED NITRATE OF SODA.—Imports reported for the month of December amounted to 4,800 tons. The stocks of this product available are now sufficient for a year's supply, but it is quite likely that some of the material will be re-exported. Prices announced in previous issues remain unchanged.

BRITISH NITRATE OF SODA.—The prices of this product remain unchanged.

NITRO-CHALK.—It is understood that small bookings have been made at the price of £7 5s. per ton, which has now been in operation for several months.

Scottish Coal Tar Products

CONSIDERABLE attention continues to be devoted to refined tar for forward delivery although many distillers are still uncertain as to their position. Other products are mainly steady excepting creslyic acid and solvents.

CRESYLIC ACID.—Supplies are plentiful with inquiries scarce. Values have been marked down as follows:—Pale, 99/100 per cent., 1s. 3½d. to 1s. 4½d. per gallon; pale, 97/99 per cent., 1s. 1½d. to 1s. 2½d. per gallon; dark, 97/99 per cent., 1s. 0½d. to 1s. 1½d. per gallon; all f.o.r. makers' works. High boiling acid is firm, however, at 2s. 6d. to 3s. per gallon.

CARBOLIC SIXTIES.—With supplies scarce value is steady at 1s. 7d. to 1s. 8d. per gallon f.o.r. in bulk for best qualities.

CREOSOTE OIL.—Market remains steady with prompt supplies rather scarce. Specification oils, 2¾d. to 3¼d. per gallon; washed oil, 3½d. to 3¾d. per gallon; gas works ordinary, 3¾d. to 4d. per gallon;; all ex makers' works in bulk quantities.

COAL TAR PITCH.—Makers are now asking round 75s. per ton ex works for the home market. Export value is nominal at about 70s. per ton f.o.b. Glasgow in bulk.

BLAST FURNACE PITCH.—No material is being made at present and orders are being fulfilled ex stock. Controlled prices remain at 40s. per ton f.o.r. works, and 45s. per ton f.a.s. Glasgow for export.

REFINED COAL TAR.—Despite numerous inquiries distillers continue to pursue a safe policy. Value to-day is about 4d. per gallon ex works in buyers' packages.

WATER WHITE PRODUCTS.—Conditions are unsatisfactory and prices are weak. Motor benzole, 1s.3½d. to 1s. 4½d. per gallon; 90/160 solvent, 1s. 2½d. to 1s. 3½d. per gallon; and 90/190 heavy solvent, 1s. 0½d. to 1s. 1½d. per gallon; all in bulk ex works.

South Wales By-Products

SOUTH Wales by-product activities continue to be on a restricted scale, business in nearly all sections being of a sporadic character. The pitch demand is confined to small, prompt parcels, the big users, especially the patent fuel manufacturers, buying with the obvious anticipation of a fall in values in mind. Quotations remain unchanged. The call for road tar is slightly better, with prices unchanged round about 13s. per 40-gallon barrel delivered. Refined tars have a steady, but moderate, call with quotations for coke-oven and gasworks tar unchanged. Naphthas continue to have a dull market, solvent having only a small call and heavy practically no call. Motor benzol continues to be a fairly bright feature, but creosote remains weak. Patent fuel and coke exports are slightly better. Patent fuel quotations, for export, are:—19s. to 19s. 3d., ex-ship Cardiff; 18s. to 18s. 3d., ex-ship Swansea. Coke prices are:—Best foundry, 32s. 6d. to 36s. 6d.; good foundry, 22s. 6d. to 25s.; furnace, 17s. to 18s.

Iodine Production in Soviet Russia

ACCORDING to current reports production of iodine in northern and eastern Russia, during 1930, amounted to approximately 1,500 kilos. Reference was made to three small iodine factories in Archangel with an aggregate production capacity of 12,000 kilos and the establishment of a factory in the Far East with a yearly maximum output of 15,000 kilos, which began operating in the latter part of 1930.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE *by Messrs. Chcs. Tennant and Co., Ltd., Glasgow, and may be accepted as representing this firm's independent and impartial opinions.*

Glasgow, January 20, 1932.

IN the Scottish heavy chemical market, inquiries are more numerous, but actual business is mostly for small quantities and immediate requirements.

ACETONE.—Quoted £66 to £68 per ton ex wharf, according to quantity.

ACID, ACETIC.—Prices ruling are as follows: glacial, 98/100%, £48 to £59 per ton; pure, 80%, £38 5s. per ton; technical, 80%, £37 5s. delivered buyer's premises Great Britain.

ACID, BORIC.—Granulated commercial, £26 10s. per ton; B.P. crystals, £35 10s. per ton; B.P. powder, £36 10s. per ton, in 1-cwt. bags, delivered Great Britain free in one-ton lots upwards.

ACID, HYDROCHLORIC.—Usual steady demand. Arsenical quality, 4s. per carboy. Dearsenicated quality, 5s. per carboy, ex works, full wagon loads.

ACID, NITRIC, 80° QUALITY.—£23 per ton, ex station, full truck loads.

ACID, OXALIC.—98 100%.—On offer at £50 to £53 per ton, ex store.

ACID, SULPHURIC.—£3 12s. 6d. per ton, ex works, for 144° quality. £7 per ton for 168°. Dearsenicated quality, 20s. per ton extra.

ACID, TARTARIC, B.P. CRYSTALS—Quoted 1s. 1¼d. to 1s. 1½d. per lb., less 5%, ex wharf.

ALUMINA SULPHATE.—Quoted £8 to £8 10s. per ton, ex store.

ALUM, LUMP POTASH.—Now quoted at £9 per ton, ex store.

AMMONIA ANHYDROUS.—Quoted 10d. to 1s. per lb., containers extra and returnable.

AMMONIA CARBONATE.—Lump quality quoted £36 per ton. Powdered, £38 per ton, packed in 5 cwt. casks, delivered U.K. stations or f.o.b. U.K. ports.

AMMONIA LIQUID, 80°.—Unchanged at about 2½d. to 3d. per lb., delivered, according to quantity.

AMMONIA MURIATE.—British dog tooth crystals quoted round £32 to £35 per ton, carriage paid according to quantity.

ANTIMONY OXIDE.—Spot material obtainable at round about £30 per ton, ex wharf.

ARSENIC, WHITE POWDERED.—Quoted £27 per ton, ex wharf. Spot material still on offer at £28 10s. per ton, ex store.

BARIUM CHLORIDE.—Price about £11 5s. per ton in casks, ex store.

BLEACHING POWDER.—British manufacturers' contract price to consumers £8 15s. per ton, in 5s. 6d. cwt. casks.

CALCIUM CHLORIDE.—British manufacturers' price, £5 5s. to £5 15s. per ton, according to quantity and point of delivery.

COPPERAS, GREEN—At about £3 15s. per ton, f.o.r. or ex works.

FORMALDEHYDE, 40%.—Now quoted £28 per ton, ex store.

GLAUBER SALTS.—English material quoted £3 15s. per ton, ex station.

LEAD, RED.—Price now £30 per ton, delivered buyer's works.

LEAD, WHITE.—Quoted £40 per ton, carriage paid.

LEAD ACETATE.—White crystals quoted round about £42 to £44 per ton c.i.f. U.K. ports. Brown on offer at about £1 per ton less.

MAGNESITE, GROUND CALCINED.—Quoted £9 per ton, ex store.

METHYLATED SPIRIT.—Industrial quality 64 o.p., quoted 1s. 8d. to 2s. 3d. per gallon.

POTASSIUM BICHROMATE.—Quoted 5d. per lb., delivered U.K. or c.i.f. Irish ports, with an allowance for contracts.

POTASSIUM CARBONATE.—96% to 98%. In good demand. Spot material on offer, £28 per ton ex store.

POTASSIUM CHLORATE.—99¾/100% Powder.—Quoted £34 per ton ex store.

POTASSIUM NITRATE.—Refined granulated quality quoted £24 10s. per ton, c.i.f. U.K. ports. Spot material on offer at about £25 per ton ex store.

POTASSIUM PERMANGANATE B.P. CRYSTALS.—Quoted 7d. per lb., ex wharf.

POTASSIUM PRUSSIATE (YELLOW).—Spot material quoted 8d. per lb., ex store.

SODA, CAUSTIC.—Powdered 98/99%, £17 10s. per ton in drums, £18 15s. in casks. Solid 76/77%, £14 10s. per ton in drums, £14 12s. 6d. per ton for 70/72% in drums; all carriage paid buyer's station, minimum four-toun lots; for contracts 10s. per ton less.

SODIUM BICARBONATE.—Refined recrystallised, £10 10s. per ton, ex quay or station.

SODIUM BICHROMATE.—Quoted 4d. per lb., delivered buyer's premises, with concession for contracts.

SODIUM CARBONATE (SODA CRYSTALS).—£5 to £5 5s. per ton, ex quay or station; powdered or pea quality, 7s. 6d. per ton extra. Light soda ash, £7 per ton, ex quay, minimum four-ton lots, with various reductions for contracts.

SODIUM HYPOSULPHITE.—Large crystals of English manufacture quoted £9 5s. per ton, ex station, minimum four-ton lots. Pea crystals on offer at £15 per ton, ex station, four-ton lots.

SODIUM PRUSSIATE.—Quoted 5d. to 5¾d. per lb., ex store.

SODIUM SULPHATE (SALTCAKE).—Price, 65s. per ton, delivered, for ground quality.

SODIUM SULPHIDE.—Prices for home consumption: solid 60/62%, £10 5s. per ton; broken, 60/62%, £11 5s. per ton; crystals 30/32%, £8 2s. 6d. per ton, delivered buyer's works on contract, minimum four-ton lots. Spot material, solid, 5s. per ton extra; crystals, 2s. 6d. per ton extra.

SULPHUR.—Flowers, £12 10s. per ton; roll, £12 10s. per ton; rock, £9 per ton; ground American, £10 per ton, ex store.

ZINC CHLORIDE 98%.—British material now offered at round about £18 10s. per ton, f.o.b. U.K. ports.

ZINC SULPHATE.—Quoted £11 per ton, ex wharf.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Manufacturing Chemists in Voluntary Liquidation

THE statutory meeting of the creditors of Thomas Powell, Ltd., manufacturing chemists, 85 Blackfriars Road, London, S.E., was held recently, at the offices of Messrs. Francis Nicholls White and Co., C.A., 73 Cheapside, London, E.C. It was stated that the shareholders had already met and had appointed Mr. A. Granville White to act as liquidator. The debenture holder had appointed Mr. O. G. Sunderland, C.A., of 15 Eastcheap, London, E.C., to act as receiver. The statement of affairs showed liabilities totalling £16,847, made up as follows:—Trade creditors, £2,720; cash claims, £8,575; bank overdraft £413, and debentures and interest £5,139. The assets were estimated to realise £5,106, and they were subject to preferential claims of £64, leaving a balance of £5,042, or a deficiency of £11,805. The company was formed with a nominal capital of £10,000, of which £4,170 had been issued and was fully paid. The deficiency as regarded the shareholders was £15,976. It was pointed out that in the ordinary course of events the whole of the assets would be absorbed in the payment of the amount due to the debenture holder and there would be no balance available for the unsecured creditors. The representative of Chas. H. Wright and Tracey, solicitors for the debenture holder, stated that their client became interested in the company some few months ago. It had been his desire to help the company and he did not wish to make any profit out of the transaction. When he had recovered the money he was out of pocket, he would give up his excess security and cancel his claim as a creditor for cash advanced. A resolution was passed confirming the voluntary liquidation of the company, with Mr. White as liquidator. A committee of inspection was also nominated.

The Canadian Chemical Industries

THE Dominion Bureau of Statistics at Ottawa reports that the value of the output from plants classified as manufacturers of chemical and allied products in 1930 was $119,969,637, as compared with $138,545,221 in 1929 and $123,677,860 in the previous year. The total capital invested was $168,119,152. The cost of materials was $48,165,038. Employees numbered 15,503, the total pay roll being $21,041,789. Chemical products associated with the manufacture of paints, pigments and varnishes led from the point of view of production value, which for the 78 establishments concerned amounted to $23,966,502. The production of acids, alkalis and salts was $20,111,602. Manufactures of soaps and washing compounds followed with 68 plants producing goods worth $18,167,838. Medicinal and pharmaceutical preparations, from 144 plants, were valued at $17,768,806.

Salammoniac in Germany

THERE is comparatively large production of solid salammoniac in Germany, a great percentage of which is used for cleaning and tinning soldering coppers. Although no statistics are available on the production of this compound exports during the first nine months of 1931 were 17,000 metric tons of which 7,900 tons were shipped to Belgium, 2,000 to the Netherlands, 1,300 to France, 1,170 to the United Kingdom, and 870 to the United States.

Manchester Chemical Market

[From Our Own Correspondent.]

Manchester, January 20, 1932.

Development in the chemical market towards expanded trade is a slow process, and during the past week new business can, at the best, be described as moderate. The cotton trade is still hoping for an eventual improvement in the important Indian market, but for the time being fresh orders are coming in slowly. The bleaching, dyeing and finishing establishments, however, are still fairly well placed on business placed some time ago and there is, in consequence, still a fairly satisfactory flow of specifications against contracts.

Heavy Chemicals

There is a fairly steady trade going through in the case of saltcake, and values in this section are maintained at about £3 2s. 6d. per ton. With regard to chlorate of soda, current quotations are ranging from about £29 to £30 per ton, with the demand on rather quiet lines. Caustic soda continues to move off in fairly steady quantities against contracts, which are quoted on the basis of £12 15s. to £14 per ton, according to grade. Phosphate of soda has attracted moderate attention during the past week, with values much as they were at last report, offers of the dibasic kind being at about £13 per ton. Bicarbonate of soda is very firm at round £10 10s. per ton, and a relatively steady business in this section is reported. The demand for sulphide of sodium is on a limited scale, but prices keep up fairly well in the neighbourhood of £11 per ton for the 60-62 per cent. concentrated solid quality, and round £9 for the commercial. Prussiate of soda meets with a moderate amount of inquiry and quotations are firm on the basis of 5d. to 5½d. per lb., according to quantity, for the crystals. Alkali is well held at about £6 per ton, and a fair trade in this section is being put through. There is no more than a quiet demand about at the moment in the case of hyposulphite of soda, which is quoted at from £15 to £15 10s. per ton for photographic crystals, and round £9 5s. for the commercial grade. Bichromate of soda is selling in moderate quantities and prices keep up at 4d. per lb. both in contracts and for prompt lots, with the former subject to discounts of from 1 to 3½ per cent., according to quantity.

Caustic potash maintains a very steady front, and offers of this materal are still at about £32 per ton. Yellow prussiate of potash is firm at about 8½d. per lb., with business on a moderate scale. There is a quiet trade going through in carbonate of potash, offers of which keep up at from £32 to £33 per ton. Chlorate of potash is on the quiet side at round £35 per ton. Bichromate of potash is maintained at the higher level of 5d. per lb., in contracts, less 1 to 3½ per cent., and the same price bought net for odd lots. Permanganate of potash meets with a quiet sale, with the B.P. quality obtainable at round 8¾d. per lb., and the commercial at 8d. to 8¼.

There is still only a comparatively small movement of sulphate of copper, offers of which are at about £18 per ton, f.o.b. Arsenic is fairly steady and nominal in the case of the white powdered, Cornish makes, at about £25 10s. per ton, at the mines; foreign varieties are quoted at about £25 per ton. Nitrate of lead is in moderate inquiry at up to £29 per ton. The acetates of lead are on the slow side but values are unchanged at about £41 per ton for brown and £44 for white. The acetates of lime are steady although business this week has been quiet; the grey material is at about £12 per ton and the brown at £8 to £8 10s.

Acids and Tar Products

Oxalic acid is in moderate request and quotations keep up at round £2 10s. per cwt., ex store. Tartaric acid is currently quoted at about 1s. 1¾d. per lb., and citric at 1s. 2d. Acetic acid is moving in fair quantities on the basis of £39 5s. per ton for the economical 80 per cent., and £52 for the technical glacial.

Among the by-products, pitch continues to command high prices for the limited supplies available, up to 75s. per ton, f.o.b., being quoted. Creosote oil is quiet but unchanged at from 3½d. to 4¾d. per gallon, naked. Carbolic acid crystals are in steady demand at from 6¼d. to 6½d. per lb., f.o.b., and crude 60's at up to 1s. 9d. per gallon, naked. Solvent naphtha is firm at from 1s. 3½d. to 1s. 4d. per gallon, naked.

British and Australian Standards

A Joint Meeting by Wireless

Under novel circumstances, a joint meeting of the British Standards Institution and the Standards Association of Australia was held on January 14, at the offices of the Board of Trade, London, and Science House, Sydney, the speeches being transmitted by wireless between the two assemblies. Colonel Sir Thomas Purves, who presided in London, read a cablegram from the Prime Minister of Australia, assuring the meeting of the Australian Government's interest in standards and stating that the Government looked forward confidently to the visit of Mr. C. le Maistre, Director of the British Standards Institution (who was present at Science House), to provide means for closer and more enthusiastic co-operation.

Mr. Walter Runciman, President of the Board of Trade, said the development of standardisation in various parts of the Empire, upon the basis of close co-operation in establishing uniform standard specifications, would make a definite and useful contribution to the growth of inter-Imperial trade. The Imperial Conference in 1930 had warmly endorsed the recommendations of the Conference on Standardisation, and the British Government viewed with keen appreciation the cordial relations which existed between the British Standards Institution and the Standards Association of Australia, and looked forward to the exercise of their functions conferring ever-extending benefits on the two countries, as well as on the other members of the British Empire.

Stimulation of Inter-Empire Trade

Sir George Julius, chairman of the Standards Association of Australia, speaking in Sydney, said the trend of world affairs in past years seemed to afford convincing evidence of the necessity for the stimulation of inter-Empire trade. Britain seemed more and more to be losing her foreign trade, and was realising the need for extending further her Empire markets, and both countries were realising more and more their mutual inter-dependence, and Government and industrial leaders in each were studying the market requirements of the other. Not the least of the efforts being made towards this end was the work of the Standards Associations, both of Great Britain and Australia, and the other parts of the Empire, which organisations for years past had been studying each others needs on the one hand, and manufacturing producers on the other, with the view of securing a maximum efficiency at a minimum cost the article or material which would satisfy the user's need. Failure in this direction on the part of the British manufacturer had resulted in the loss to Britain of large sections of possible trade in Australia. Equally, Australia's primary producers failed adequately to understand the markets for such products in the old country, and thus found it difficult to compete in those markets.

Mr. Maurice Wilson, chairman of the British Standards Institution, said all its committees were anxious to meet the Australian views as far as possible. They were both advancing along the lines recommended at the last Imperial Conference.

Mr. Le Maistre's Visit

Sir Henry Barraclough (Sydney) said the visit of Mr. le Maistre was a notable event in the history of the Australian Association, and his wise counsel and his strong personality had made a deep impression. He feared they were expressing their welcome by working him to death, but the service he had rendered to their standardisation movement could not be exaggerated.

Mr. C. le Maistre said that as a representative of the British Standards Institution visiting Australia with the full support of the Board of Trade and the Empire Marketing Board he had been received everywhere with the greatest cordiality. One certainly had to visit Australia to appreciate the tremendous affection the Australians had for the old country and the Australians were as eager as we were to follow the advice of the Prince of Wales to buy British in preference to foreign goods. But British manufacturers must realise that because of inter-climatic and other local conditions the Australian requirements were often different from those in England. Australian secondary industries must obviously continue to grow and flourish and the British manufacturers, realising this, should make the utmost use of the overseas officers of the Board of Trade.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

London Gazette, &c.

Company Winding Up Voluntarily

NOVOCRETE & CEMENT PRODUCTS COMPANY (NORTHERN AREA) Ltd. (C.W.U.V.23/1/32). By reason of its liabilities. January 12. Mr. Richard Castle, 5 Chancery Lane, London, W.C.2., appointed liquidator.

Company Winding Up

ALLIED CEMENT MANUFACTURERS, Ltd. (C.W.U. 23/1/32). Statutory meetings at Royal Venetian Chamber, Holborn Restaurant, High Holborn, London, January 27; creditors at 11 a.m., contributories 12.15 p.m.

New Companies Registered

THE BRITISH OTTO OZONE WATER, WOOD AND TEXTILES TREATMENT CO., LTD.—Registered as a "private" company on December 17. Nominal capital £20,000 in £1 shares. To acquire the whole or any part of the undertaking and assets of The British Water, Wood and Textiles Ozone Treatment (Syndicate), Ltd., to acquire patents and inventions relating to any of the uses or applications of ozone and for the production of ozone, to acquire the sole and exclusive rights and interests for the British Empire and the U.S.A. of all patents, processes and methods concerning or applicable to the Otto Ozone Process and method for the purification of water, its treatment and supply, the seasoning of wood, as well as any other applications of Otto Ozone patents, processes and methods, except the bleaching of textiles, to acquire options for the purchase of the sole rights for the British Empire and U.S.A. of all patents and processes or methods of the Crispi and Otto processes and methods for the bleaching of textiles, etc. Directors: G. E. Morgans, 132 New Kings Road, Fulham, London, S.W.; H. W. Lewin, Dr. Rarius P. Otto, Dr. Emile Stern.

CALLOY LTD. Registered as a "private" company on January 16. Nominal capital £10,000 in £1 shares. The objects are to acquire from G. N. Kirsebom the world's rights (so far as he can grant the same) in G. N. Kirsebom's processes and methods for the preparation of the alkaline earth metals and/or the alkali metals, the preparation and refining of metals and alloys and the recovery of possible by-products by the utilisation of the alkaline earth metals and/or alkali metals, etc., and to adopt agreements with the said G. N. Kirsebom and the National Smelting Co., Ltd. A subscriber:—V. Summers, 2 Bond Court, Walbrook, London, E.C.4. Directors: G. N. Kirsebom, F. Kirsebom, S. Robson and L. B. Robinson.

PLYMOUTH VARNISH & COLOUR COMPANY, LTD. Registered December 28. Nominal Capital £4,000 in £1 shares. Manufacturers and importers of, agents for and dealers in colours, paints, varnishes, lacquers, cellulose products and solvents, bituminous paints, enamels, etc. Directors:—G. E. Stephens, "Burrdown," Yelverton, Devon; T. J. F. Roose.

RAVENOID CELLULOSE PRODUCTS, LTD. Registered January 7. Nominal capital £1,000 in £1 shares. Cellulose, lacquer, enamel, paint, oil, colour, lead and chemical manufacturers and merchants, etc. Directors: E. Chapman, 176 Boothferry Road, Hull; J. A. Dent, C. C. D. Johansen, Joseph Henry Millard, Joseph Hugh Millard, T. P. Millard.

RIVER CHEMICAL CO., LTD. Registered January 6. Nominal capital £3,000 in £1 shares. To acquire the business of a chemical dealer and fine chemical manufacturer carried on by Hilda Mary Derrickat Lion Works, Moorgate Street, Nottingham, as "River Chemical Company." Directors: Mrs. H. M. Derrick, 128 St. Ann's Well Road, Nottingham; and W. Derrick.

ROBERT EMERY, LTD., Waterloo Colour Works, Waterloo Road, Cobridge, Stoke-on-Trent.—Registered December 17. Nominal capital £7,000 in £1 shares. To acquire the business of colour makers carried on by R. R. Emery and H. J. Emery at Waterloo Colour Works, Waterloo Road, Cobridge, Stoke-on-Trent, as "Robert Emery." Directors: R. R. Emery, Mary Emery.

UNIVERSAL COLOUR AND CHEMICAL CO., LTD., 39 Mincing Lane, London. Registered December 31. Nominal capital £100 in £1 shares. Oil and colour men. Directors: C. G. Fleetwood, Edith S. Fleetwood, and B. A. Bryer.

Chemical Trade Inquiries

These inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country) except where otherwise stated.

BRAZIL.—A commission agent in Rio de Janeiro wishes to communicate with United Kingdom manufacturers of chemical and medicinal products with a view to representation on a commission basis. (Ref. No. 130.)

CHINA.—A commission agent of British nationality in Shanghai desires to secure the agency of United Kingdom manufacturers of industrial chemicals, tinplate and general merchandise. (Ref. No. 122.)

SYRIA.—A Beirut firm of commission agents desires to be placed in touch with United Kingdom firms exporting mineral oils for motor car engines, pharmaceutical and toilet specialities. (Ref. No. 123.)

New Chemical Trade Marks

These lists are specially compiled for us from official sources by Gee and Co., Patent and Trade Mark Agents, Staple House, 51 and 52 Chancery Lane, London, W.C.2, from whom further information may be obtained, and to whom we have arranged to refer any inquiries relating to Patents, Trade Marks and Designs.

Opposition to the Registration of the following Trade Marks can be lodged up to February 6, 1932.

AETHALIN.

527,879. Class 1.—Chemical substances for use in the treatment of textile fabrics anl leather, in the course of their manufacture. H. Th. Bohme Aktiengesellschaft (a Joint Stock Company organised under the laws of Germany), 29 Moritzstrasse, Chemnitz, Germany; manufacturers.—December 15, 1931.

ZOPAD.

527,791. Class 2.—Chemical substances used for sanitary purposes. Thornton & Ross, Ltd., The Chemical Works, Colne Vale Road, Milnsbridge, Huddersfield; Chemical manufacturers.—December 11, 1931.

Tariff Changes

NETHERLANDS.—The Commercial Secretary to H.M. Legation at The Hague now reports that a law has been passed imposing a petrol tax of 6 florins per 100 kilogs., with effect from January 1, 1932.

POLAND.—A Ministerial Order dated December 22, 1931, and effective as from January 1, 1932, amends the "General" Tariff rates of Customs duty on goods covered by certain items of the Polish Tariff, as follows:—

	Zlote per 100 kilos. Former	New
Cooking salt, cattle salt and refined salt	0.60	3
Albumen and its derivatives	15.60	80
Chrome alum	26.	35
Caustic soda:—		
(1) Unpurified	14.30	30
(2) Purified	96.20	96
Caustic potash:—		
(1) Unpurified	14.30	40
(2) Purified	96.20	96
Sulphide of sodium	26	30
Aniline	16.20	150
Toluidine, naphthylamine, parametanitraniline	16.20	16
Biphenylamine and salts	350	350
Biaminotoluidine and salts	500	500
Ferro-silicon, containing more than 15 per cent. of silicon	18.20	36